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THE AGRICULTURAL GAZETTE OF CANADA

Vol. X November-December, 1923 No. 6

STORAGE

LEADING TOPICS

Canadian Wheat and Wheat Flour
Forage Crop Improvement
Agricultural Instruction Grant, 1923-24
Some Pathological Phases of Bovine Reproduction
A Visit to British Shows, Flocks and Herds
Ontario Agricultural Societies
Dairying in British Columbia
Agricultural Instruction for Juniors, Ontario
Accredited Herd Register
Higher Agricultural Education
Agricultural Meteorology

DEPARTMENT OF AGRICULTURE
OTTAWA, CANADA

The Agricultural Gazette of Canada is published bi-monthly, in English and in French, by the Dominion Department of Agriculture, Ottawa.

The aim of The Agricultural Gazette is to provide a source of information as to the policies and activities of the Dominion Department of Agriculture and of the Provincial Departments of Agriculture and of Education, so far as the work of the latter relates to Agricultural Education. Besides being a publicity medium, it constitutes a comprehensive record of the progress and development of departmental effort on behalf of Agriculture in Canada.

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DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
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The AGRICULTURAL GAZETTE
OF CANADA

J. B. SPENCER, Director of Publicity
Wm. B. VARLEY, Editor

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OTTAWA

MAP OF CANADA SHOWING THE LOCATION OF FARMS, STATIONS AND SUB-STATIONS IN THE EXPERIMENTAL FARMS SYSTEM, THE AGRICULTURAL COLLEGES AND AGRICULTURAL SCHOOLS

CONTENTS

PART I

DOMINION DEPARTMENT OF AGRICULTURE

	Page
Canadian Wheat and Wheat Flour	499
Forage Crop Improvement, by G. P. McRostie, Ph.D., Dominion Agrostologist, Central Experimental Farm	514
Agricultural Instruction Grant, 1923-24	517
Experimental Beef Shipments	519
Cow Testing	520
Importation of Nursery Stock	521
The Seeds Act, 1923	522
Fruit Drying Project	522

PART II

PROVINCIAL DEPARTMENTS OF AGRICULTURE

Some Pathological Phases of Bovine Reproduction, by Alfred Savage, Animal Pathologist, Manitoba Agricultural College	523
A Visit to British Shows, Flocks and Herds, by H. G. Robertson, Live Stock Commissioner, Saskatchewan	534
The Agricultural Societies of Ontario, by J. Lockie Wilson, Superintendent	541
Agricultural Representative Work in New Brunswick, by J. E. McIntyre, B.S.A., Bathurst, N.B	543
Dairying in British Columbia, by Henry Rive, Dairy Commissioner	544
Departmental Changes in Manitoba	546

PART III

AGRICULTURAL EDUCATION AND RELATED ACTIVITIES

Agricultural Instruction for Juniors in Ontario, by R. S. Duncan, Director Agricultural Representatives, Ontario Department of Agriculture	547

PART IV

SPECIAL CONTRIBUTIONS, REPORTS OF AGRICULTURAL ORGANIZATIONS, PUBLICATIONS AND NOTES

Accredited Herd Register	550
The Canadian Horticultural Council	556
Vegetable Vitamins, by L. F. Burrows, Secretary, Canadian Horticultural Council	558
New Plant Originations Protected	559
Live Stock Exports	560
Flax Experiments	560
The Canadian Colonization Association's Land Lists	561
Canadian Veterinary Medical Association	561
Butter Substitutes Excluded	562
Quarantine and Inspection of Foxes Entering Prince Edward Island	562
Information About Canada	562
News Items and Notes	563
Appointments and Staff Changes	564
Associations and Societies	565
New Publications	565
The Library	566

PART V

INTERNATIONAL INSTITUTE OF AGRICULTURE

PAGE

FOREIGN AGRICULTURAL INTELLIGENCE—

SCIENCE AND PRACTICE OF AGRICULTURE:

THE HIGHER AGRICULTURAL EDUCATION OF THE FUTURE 569

AGRICULTURAL METEOROLOGY AS A FIELD FOR INVESTIGATION 572

CROPS AND CULTIVATION 576

LIVE STOCK AND BREEDING 578

AGRICULTURAL INDUSTRIES 582

PLANT DISEASES 583

OTHER ARTICLES ON SCIENCE AND PRACTICE OF AGRICULTURE 585

THE INTERNATIONAL REVIEW OF AGRICULTURAL ECONOMICS 586

CO-OPERATIVE LIVE STOCK SHIPPING ASSOCIATIONS IN THE UNITED STATES 587

AGRICULTURAL STATISTICS 589

THE AGRICULTURAL GAZETTE OF CANADA

INDEX TO VOLUME X 599

The AGRICULTURAL GAZETTE
OF CANADA

VOL. X NOVEMBER-DECEMBER, 1923 No. 6

CANADIAN WHEAT AND WHEAT FLOUR

The Crop

THE bulk of Canada's wheat is grown in the three Prairie Provinces of Manitoba, Saskatchewan and Alberta. More than half the total is the product of a single province—Saskatchewan. According to the preliminary estimate of the Dominion Bureau of Statistics, the total wheat production in bushels of the three provinces in 1923 was 446,775,000, and for the rest of Canada 23,553,000, making a total of 470,328,000, or the largest wheat crop ever grown in this country. By provinces, production in 1922 and 1923* was as follows:

Province	1922	1923
	bushels	bushels
Manitoba	60,051,000	38,636,000
Saskatchewan	250,167,000	259,017,000
Alberta	64,976,000	149,122,000
British Columbia	1,035,000	1,194,000
Ontario	19,893,000	19,101,000
Quebec	2,286,000	2,228,000
Nova Scotia	293,600	258,000
New Brunswick	396,000	257,000
Prince Edward Island	688,800	515,000
Total Canada	399,786,400	470,328,000

The total area devoted to field crops in 1922 was 57,200,681 acres, while the area devoted to wheat was 22,422,693 acres in 1922 and 22,730,149 acres in 1923. The total acreage devoted to wheat in the Prairie Provinces in 1923 was 21,663,360 acres, and in 1922, 21,223,448 acres.

The total value of Canada's wheat crop in 1922 was $339,419,000 which was slightly in excess of the average for the previous five years, 1917-21. Of all other field crops the aggregate value was $592,444,670. Thus the value of the wheat produced was considerably more than one-half of all other field crops combined.

Canada's wheat crop in 1915 of 393,500,000 bushels from 15,000,000 acres, went down to history as the largest this country had ever produced up to that time. It was that crop which enabled Canada to greatly augment the food supply of the Allies. Bountiful nature came to the assistance of the Canadian farmer in a wonderful degree in that year of crisis, and while the volume of production was exceeded in 1922, and again in 1923, the 1915 record of 26 bushels per acre still stands, and is likely to do so far some time to come.

For all Canada, the yield per acre in 1922 averaged 17·75 bushels for both spring and fall wheat. For 1923 the average was 20·75 bushels (fall wheat 24·25; spring wheat 20·50). The average for the five years 1917-21

*Preliminary estimate,

was 12·25 bushels for spring wheat and 22·25 bushels for fall wheat, and for both classes, 12·75 bushels, and the decennial average 15¾ bushels. In the same five-year period the average weight per measured bushel was fall wheat 60·13 pounds, spring wheat 58·77 pounds, and of all wheat 59·10 pounds. The average weight per bushel of the spring wheat crop of 1922 was 60·31 pounds.

Relative Position

To what extent is Canada a controlling factor in the production and price of wheat? With a production of approximately 400 million bushels, Canada, in 1922, took second place among the wheat-producing countries of the world, being exceeded only by the United States. In 1923, with a production of 470 million bushels, her position is still maintained.

The relative position in 1922 of the leading wheat-producing countries, Russia not included, as indicated by statistics supplied by the International Institute of Agriculture, was as follows:

Countries	Production bushels
United States	862,000,000
Canada	399,786,000
India	367,135,000
France	243,317,000
Argentina	189,047,000
Italy	161,643,000
Spain	125,470,000
Australia	107,263,000

From the same source, it is ascertained that the world's total production of wheat in 1922 was 3,103,278,000 bushels, of which amount Canada contributed a little more than one-eighth.

PRODUCTION OF WHEAT IN THE BRITISH EMPIRE

Country	1923	1922	1921	Pre-War Average 1909-1913
	bushels	bushels	bushels	bushels
United Kingdom	61,000,000	65,249,000	73,795,000	59,640,000
Canada	470,328,000	399,786,000	300,858,000	197,118,000
India	369,263,000	367,135,000	250,356,000	359,035,000
South Africa	(a)	6,696,000	8,689,000	6,520,000
Australia	(a)	107,263,000	132,285,000	90,500,000
New Zealand	(a)	8,500,000	10,565,000	7,070,000
Totals		954,629,000	776,548,000	719,883,000

(a) Harvest to take place in December-January.
Statistics furnished by the International Institute of Agriculture.

Wheat Exports

Canada's position as a producer of wheat has somewhat obscured the far more significant fact that she is the largest single contributor to the world's supply, having more surplus wheat for export than any other wheat-growing country. For the international grain year ended August 1, 1923, Canada exported, according to the International Institute of Agriculture, no less than 279,000,000 bushels of wheat and flour reduced to wheat, compared with 199,000,000 bushels from the United States, 144,000,000 bushels from Argentina, 53,000,000 bushels from Australia, and from India 28,000,000 bushels. Thus to the total of 696,000,000 bushels exported by the leading countries, Canada contributed two-fifths.

For 1923-24 Canada's contribution to the world's requirements is likely to be still greater. Estimating those requirements at 668 million bushels against 700 million taken in 1923, Canada should be in a position to export 300 million bushels, compared with probable shipments from other exporting countries aggregating 375 million bushels, made up of 150 million bushels from the United States, 110 from Argentina, 50 from Australasia; from India, 30; Balkans, 10; *Russia, 15; South Africa, 10.

For wheat the United Kingdom is Canada's best customer. According to the Dominion Bureau of Statistics the exports of wheat for the crop year, September 1, 1922, to August 31, 1923, were 229,681,814 bushels valued at $263,819,430. Of this amount, 174,011,494 bushels went to the United Kingdom and 12,936,048 to the United States. Other countries to which exports were not less than two million bushels were Belgium, France, Greece, Italy, Japan, and the Netherlands.

The following is a statement, by countries, of the quantities of Canadian wheat exported during the years 1921, 1922 and 1923, the fiscal year ending March 31 being taken:

EXPORTS OF CANADIAN WHEAT

Country	1921	1922	1923
	Bushels	Bushels	Bushels
United Kingdom	29,294,612	92,498,351	166,846,960
United States	42,324,894	16,592,797	16,213,629
Belgium	14,069,843	4,069,245	5,348,388
France	5,051,461	1,111,752	3,188,274
Germany	1,832,739	1,219,257	1,185,984
Greece	4,667,639	3,794,535	4,055,703
Italy	21,048,458	10,298,424	8,192,537
Japan		2,425,915	2,610,012
Netherlands	6,976,125	2,585,885	4,448,610
Sweden	673,443	360,396	889,714
Other Countries	3,275,943	1,532,681	2,094,755
Totals	129,215,157	136,489,238	215,074,566

Flour Milling

With the development of Western Canada, wheat became the chief raw product of Canadian agriculture, and flour and grist milling, always a leading and characteristic Canadian industry, now competes with the meat packing industry for first place among our manufactures in the value of its product.

The growth of the milling industry—flour and grist—since the confederation of the provinces of Canada is indicated by the following figures: In 1871 the amount of capital invested was $10,000,000 compared with $62,000,000 in 1921; the value of the raw materials used was $32,500,000 as against $165,000,000, and the value of the products, $39,000,000 as against $195,000,000. In the same period the quantity of wheat flour exported increased from 300,000 barrels to 6,000,000 barrels, and stood in 1922-23 at 10,000,000 barrels.†

* Estimates of Russia's probable exports are purely tentative, but it may be assumed that she will be compelled by circumstances to export a considerable quantity of wheat in 1923-24.

During the grain years 1908-09 to 1912-13, Russia's exports of wheat and flour averaged 151,787,000 bushels.

† "In the crop year 1917-18, Canada supplied the Allies in the Great War 10,000,000 barrels of much needed flour in addition to her exports of wheat." *Essays on Wheat*: Buller.

There are at the present time 624 flour mills in operation in Canada with a total capacity of 128,225 barrels of flour per diem. Of this number 163 are large mills with a combined daily capacity of 110,000, the capacity of the largest being 14,000 barrels.

Flour mills exist in each of the nine provinces. Those of the greatest capacity are located at Montreal, Quebec, at Kenora and Port Colborne, Ontario, and at Winnipeg, Manitoba. It is anticipated that the development of the Pacific trade will stimulate the growth of the industry in Western Canada.

The total quantity of wheat flour produced in Canada in 1921 was 15,321,759 barrels, being the product of 70,000,000 bushels of wheat.

The total annual capacity of Canadian mills is in the neighbourhood of 30 million barrels. This is far beyond the needs of domestic consumption, computed at 8,000,000 barrels annually, and a large portion of the wheat crop is marketed overseas in the form of flour.

Flour Exports

Returns for the crop year 1922-23 (August 31) show that 11,069,054 barrels of Canadian wheat flour valued at $62,891,156 were exported to over fifty countries. As in the case of wheat, the United Kingdom was the largest purchaser, taking 4,697,745 barrels as against 432,607 barrels taken by the United States. Newfoundland and the British West Indies accounted for nearly a million barrels, and various other countries for the remainder.

The total exports of wheat flour for the fiscal years (ended March 31) 1914 and 1919-23 were as follows:

	Barrels
1914	4,832,183
1919	9,205,439
1920	8,863,068
1921	6,017,032
1922	7,414,282
1923	10,227,060

Quality

The quality of Canadian wheat and wheat flour has created a demand from all sections of the globe for these products, her wheat being sold direct to over fourteen countries and wheat flour to over fifty countries.

For ten years in succession Canada succeeded in carrying off the wheat championship of the world, either with the Marquis variety or a variant of it.

The determining factors in the strength of wheat are climate, soil and variety. Hard wheat such as that grown on the central plains of Canada, yields a flour high in protein and produces a very light bread. Soft wheat, produced in moister climates, yields starchy flour, and a bread that is more compact in texture. When mixed with softer wheats, Canadian hard wheat gives " strength " to the flour, which absorbs a high degree of moisture, resulting in a big, bold loaf. For these purposes it is essential, and is equal in value and quality with " Hungarian Hard."

Future Prospects

It has been demonstrated in the foregoing that Canada ranks first as an exporter and second as a grower of wheat. While the increase has been rapid, it would be hazardous to predict that it will continue at its present

rate, in spite of the fact that there are many thousands of acres still available in Western Canada for the production of grain. Further expansion, or even the maintenance of the present volume of production, is dependent primarily on satisfactory profits to the grower. Profits depend upon costs and prices, and prices on the ratio between world supply and demand.

The probability of an increasing surplus from Russia and the necessity of European countries making their purchases in countries where exchange is more nearly on a parity than it is with Canada, are considerations that add to the difficulty in forecasting the future. Nor is the fact to be lost sight of that there is a marked tendency in the Canadian West to turn from wheat to more diversified lines of farming, such as live stock and dairying. Sound principles of husbandry demand this, and while on the one hand the influx of new settlers may increase the area devoted to grain crops, that area may, on the other hand, tend to diminish in well established districts.

Confidence in Canada's ability to meet competition is strengthened by the fact that Canada produces what, on the whole, is the best wheat in the world, having regard to quality, purity and reliability of grade.

Physical Equipment

To convey her surplus products to the world's markets, which for such products as wheat, meat, cheese and butter, lie chiefly overseas, physical facilities of all kinds have been provided, involving a vast expenditure of capital. On land, railways have been built and completely equipped from ocean to ocean; chains of interior grain elevators exist throughout the prairies; gigantic batteries of elevators, or warehouses, have been constructed at railway terminals and transhipping points. To enable advantage to be taken of the inland water highways provided by the Great Lakes and the river St. Lawrence, an extensive system of canals has been constructed, including the Welland Canal, connecting lakes Erie and Ontario, which is second only in magnitude to the Panama Canal. Associated in this has been the development and equipment of ports, harbours and waterways, not to mention a fleet of grain-carrying vessels on the lakes. To facilitate buying and selling the standardization and grading of wheat has been instituted, and a system of financing and marketing has been built up.

To the cultural aspect of wheat growing Canada has made a contribution of untold value in the origination and introduction of varieties particularly adapted to the great plains of the North American continent.

Varieties

The successful development of wheat growing in Western Canada is in a large measure due to the introduction of two superior varieties of wheat found suited to western climatic conditions. The first of these varieties, Red Fife, was discovered fortuitously by a Canadian farmer. The second, Marquis, was originated by the Experimental Farms Branch of the Dominion Department of Agriculture. The introduction of these varieties in Western Canada, and to a wide extent in the spring wheat areas of the United States, has not only improved the quality of the wheat grown, but has increased the yield of this continent by many millions of bushels.

About the year 1842, David Fife, a Scotch pioneer farmer of the province of Ontario (then known as Canada West) selected the variety that bears his name, from seed tracing to Central Europe, and now recognized as

identical with a European variety known as Galician. This proved to be a productive hard spring wheat of fine milling and baking qualities. By 1870, Red Fife had become the spring variety most generally grown in Ontario, and early in the eighties it became the leading variety in Manitoba, replacing the softer varieties. With the settlement of the provinces of Saskatchewan and Alberta, it spread throughout the West, where it was grown almost universally. Marquis, the successor of Red Fife, was selected in 1903 and distributed in 1909 by Dr. Charles E. Saunders, Dominion Cerealist, from

Harvesting grain on a Prairie Farm in Western Canada

among a number of cross-bred varieties originated by the Experimental Farms Branch. The male parent was Red Fife, and the female, Red Calcutta (a type name). This wheat, because of the qualities of its gluten content, was found to produce a remarkably good flour and a large and palatable loaf. Being a better yielder than Red Fife and ripening one week earlier, thus making it less liable to frost and rust, it had in a few years almost entirely superseded its parent variety. To-day, more than 80 per cent of the wheat of Western Canada is Marquis, and in the United States it is the most generally grown spring wheat, occupying in 1919, 11,825,000 acres or 38·8 per cent of the spring wheat area, and 16 per cent of the total wheat area.

The introduction of these two wheats has added greatly to the actual wealth of Canada and the United States, besides contributing materially to the development of the Western Provinces.

Prelude wheat, another variety originated by the Dominion Experimental Farms, was introduced into Manitoba and Saskatchewan in 1911. Prelude is a hard, red, bearded variety of unusual weight, and although not as heavy a yielder as Marquis, it ripens about two weeks earlier. On account of this advantage, it is proving of great value in extending the area of successful wheat growing in the central and northern sections of the Canadian West.

In the northerly extension of the wheat area, another variety originated at Ottawa is also playing a part. This is Ruby, Ottawa, 623, distributed in 1919. Ruby is a hard, red, beardless variety, coming midway in ripening between Marquis and Prelude, and is proving of value in districts where

Marquis does not ripen satisfactorily. Ruby wheat gives a fair yield, and makes flour of the highest quality as regards colour and strength, while bread made from it ranks in the first class.

Grading

All wheat is graded by government inspectors at terminal elevators and sold both at home and abroad on grade certificate. Sample markets serve as a rule only local requirements.

The grades of wheat are defined by The Canada Grain Act. This act, which is administered by a Board of Grain Commissioners, regulates and controls the business of handling wheat and other grain.

The grain inspection service is divided into the Eastern and Western divisions, each being confined to its own territory, but the same system of grading prevails throughout. The grade is determined by the degree of purity, cleanness, soundness, weight, condition, and milling qualities as indicated by the degree of hardness.

The four highest grades are established by statute and do not vary from year to year. The lower, or "commercial grades," of which there are three, cannot be established as they are dependent on the climatic conditions under which the crop is produced. The lower grades are therefore defined annually by the Grain Standards Board. As there is often a spread of several cents between grades, the profitableness of the crop to the grower is dependent in no small degree on the grade range.

To assist the Grain Standards Board in establishing the commercial grades on a scientific basis, a government grain research laboratory has been provided. This laboratory investigates the milling and baking qualities of the crop, as well as specific problems arising from seasonal conditions.

The following table gives the percentages of each of the grades of western spring wheat inspected during the crop years 1920-21, 1921-22 and 1922-23. The amount of winter wheat grown in Western Canada is negligible. The figures quoted were supplied by the Board of Grain Commissioners for Canada:—

Grade	Percentages		
	1920-21	1921-22	1922-23
No. 1 Hard	·09	1·21	·33
No. 1 Northern	38·06	29·87	65·65
No. 2 Northern	23·68	20·30	16·80
No. 3 Northern	24·47	23·81	9·31
No. 4	5·32	8·62	·77
No. 5	·90	2·44	·21
No. 6	·29	·71	·06
Below "Commercial" grade	7·19	13·04	6·87
	100·00	100·00	100·00

The foregoing statement indicates that 86·30 per cent of the Western spring wheat crop of 1920-21, 75·19 per cent of the crop of 1921-22 and 92·09 per cent of the crop of 1922-23 came within the four grades established by statute. The percentage of "commercial" grades was 6·51 in 1920-21, 11·77 in 1921-22 and 1·04 in 1922-23.

As an indication of the magnitude of the work of grading, it may be stated that the quantity of wheat inspected in the Western Division in 1923, was 279,256,700 bushels, comprising 228,659 car loads.

Transportation and Storage

After the crop is harvested and threshed, the farmer delivers it to the country elevator—or loads on cars direct from the station loading platform—whence it is shipped by rail to the terminal elevator. Inspection takes place at the terminal elevators, and there the wheat is classified and stored, sold and shipped, according to grade. The terminal elevators are owned either by the Government or by private concerns. They are located at Port Arthur and Fort William at the head of the lakes and at convenient interior points such as Winnipeg, Moose Jaw, Saskatoon and Calgary. The interior terminal elevators not only provide storage, particularly after lake navigation has ceased, but also facilities for treatment, such as cleaning or drying, when this is required.

Country Grain Elevators at Virden, Manitoba.

At the end of 1922 the number of country grain elevators in the three Prairie Provinces was 3,929, and their total capacity, 129,961,420 bushels, by provinces was as follows:*

Province	Number	Capacity
		bushels
Manitoba	693	21,325,100
Saskatchewan	2,304	72,542,320
Alberta	932	36,094,000
Total	3,929	129,961,420

The location and capacity of the principal terminal and public grain elevators at the end of the year 1922 is given as follows:*

	Number	Capacity
		bushels
Interior Prairie Terminal Elevators:—		
Winnipeg, (Transcona, North Transcona)— Moose Jaw, Saskatoon, Calgary	7	11,835,000
Lake Port Elevators:—		
Upper Lakes:— Fort William, Port Arthur	28	56,810,000
Georgian Bay:— Goderich, Port McNicoll, Tiffin, Depot Harbour, Midland	7	13,800,000
Lower Lakes:— Port Colborne, Prescott	3	4,500,000
Atlantic Port Elevators:— Montreal, Quebec, St. John, Halifax	10	14,350,000
Pacific Port Elevators:— Vancouver	1	1,250,000
Total	56	102,545,00

The ownership of the country elevators is in the hands of the farmers' co-operative companies, private elevator companies and milling companies. Among the farmers' organizations in Western Canada, organized for trading in grain and other commodities, are United Grain Growers, Limited, and the Saskatchewan Co-Operative Elevator Company, Limited. These two companies control not only a large number of country elevators but also storage at the head of Lake Superior, and between them handle a large proportion of the western crop. According to information supplied by United Grain Growers, Limited, that organization, in 1923, comprised approximately 35,000 farmer shareholders. It controlled 364 country elevators with a capacity of 10,662,000 bushels, as well as storage capacity for 3,100,000 bushels at terminal points, and in the crop year 1922-23, handled approximately 30 million bushels of grain.

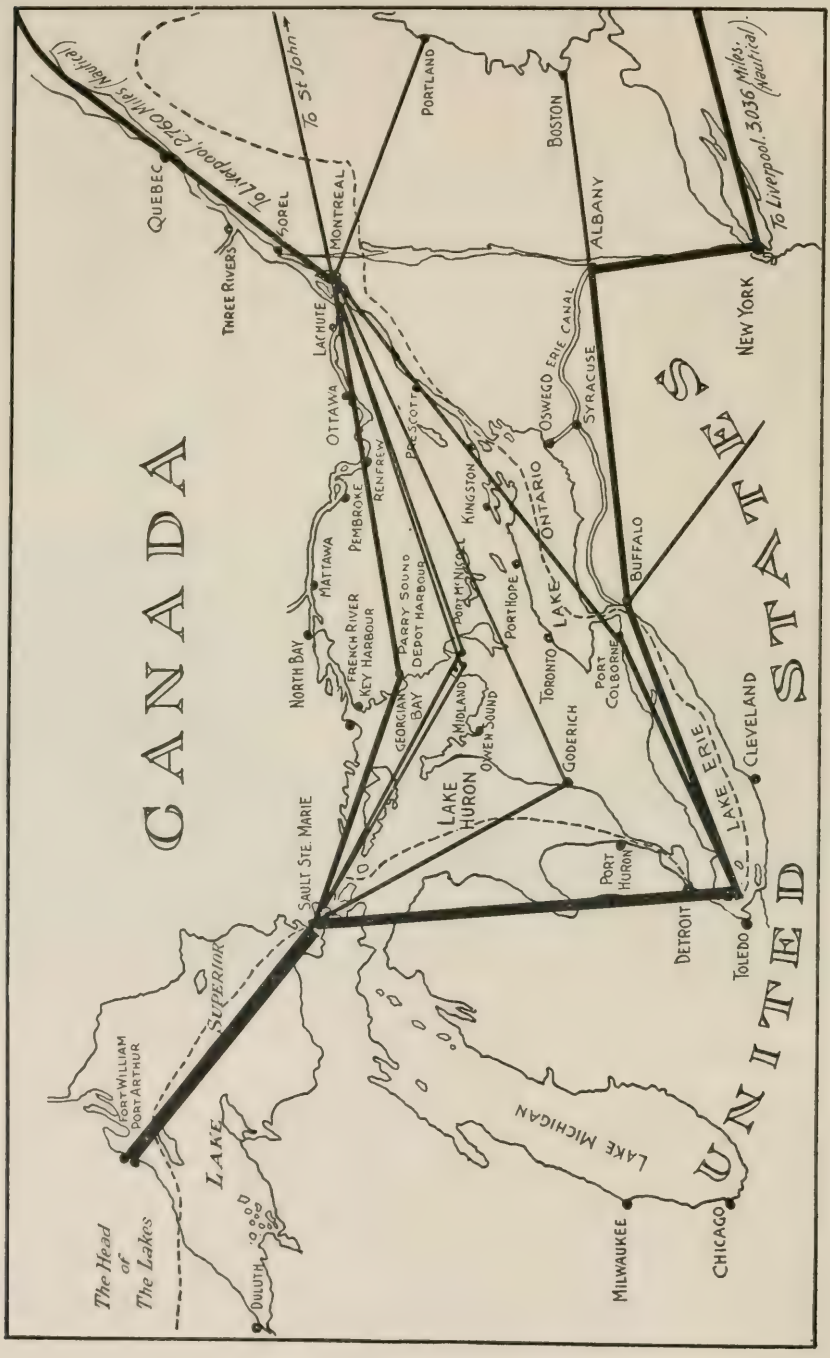
The Saskatchewan Co-operative Elevator Company, comprising 23,000 farmer shareholders, operates 354 country elevators, having a total capacity of ten and a half million bushels, and a terminal plant with a capacity of 7,750,000 bushels. This one company claims to have handled 43 million bushels of all grains in 1922-23.

The terminal elevators at the twin ports of Fort William and Port Arthur at the head of Lake Superior have a combined storage capacity of approximately 60,000,000 bushels, which is greater than either Chicago, Minneapolis or St. Paul in the United States. The total receipts of wheat at these ports in the crop year 1922-23 was 244,915,000 bushels, and the shipments, lake, 229,819,000 bushels, rail, 18,424,000 bushels.

Channels of Export

From the terminal elevators at the head of Lake Superior the wheat is transported through the Great Lakes to various trans-shipping points. Wheat destined for shipment via the port of Montreal is conveyed either to the Georgian Bay and Lake Huron elevators, and thence by rail to Montreal, or else is transported all the way by water to that port, where it passes through the port elevators to ocean vessels. During the winter months, export wheat is conveyed by rail chiefly to the ocean port of St. John, New Brunswick, and to Portland in the State of Maine. From St. John 12,000,000 bushels and from Quebec, 2,654,500 bushels were shipped in 1923.

* Statistics supplied by Natural Resources Intelligence Services, Department of the Interior.



Grain Routes from the Head of the Lakes.

Wheat destined for export through the United States ports of Boston, New York, Philadelphia, and Baltimore is for the most part conveyed by vessel from the head of the lakes to the port of Buffalo, N.Y.

The vessels engaged in grain transportation on the Great Lakes are chiefly of American, Canadian and British registry. The lake vessels often have a carrying capacity of 300,000 bushels, which is equivalent to six or seven trains of 40 cars of 1,200 bushels. The vessels are loaded by gravity direct from the elevators situated on the water front at an average of 75,000 to 100,000 bushels per hour.

Statistical returns published by the Dominion Bureau of Statistics make evident the fact that a large proportion of the wheat and flour exported by this country passes through other than Canadian channels after leaving the head of the lakes. Of 174,000,000 bushels of wheat exported to the United Kingdom during the crop year ended August 31, 1923, 125,500,000 bushels were shipped via United States ports compared with 48,500,000 via Canadian ports. Of 4,697,745 barrels of flour destined for the United Kingdom, in 1923, 1,549,450 barrels left via the United States and 3,148,295 via Canadian ports.

Commenting upon this aspect of our export business, the report of the Harbour Commissioners of Montreal, 1922, p. 8, says:—

"It thus appears that though Canadian capitalists and taxpayers have provided, within the bounds of their own country, large storage and ample transit facilities at every stage in the movement of the crop to market . . . . yet the marketing and thus the forwarding of more than three-fifths of the grain is controlled by agencies which see to it that tribute and toll are paid to transit systems competing with our own."

That so small a percentage of Canadian export wheat reaches the Atlantic seaboard by the St. Lawrence route in spite of the recognized efficiency and superiority of Canadian transportation and harbour facilities is a matter affecting Canada's most vital interests.

Government Elevator System

Terminal and public elevators, owned by the Government of Canada, have been erected at various points throughout Canada from Halifax to Vancouver. They are eight in number and are under the control of the Board of Grain Commissioners; their location, capacity and operation being as follows:*

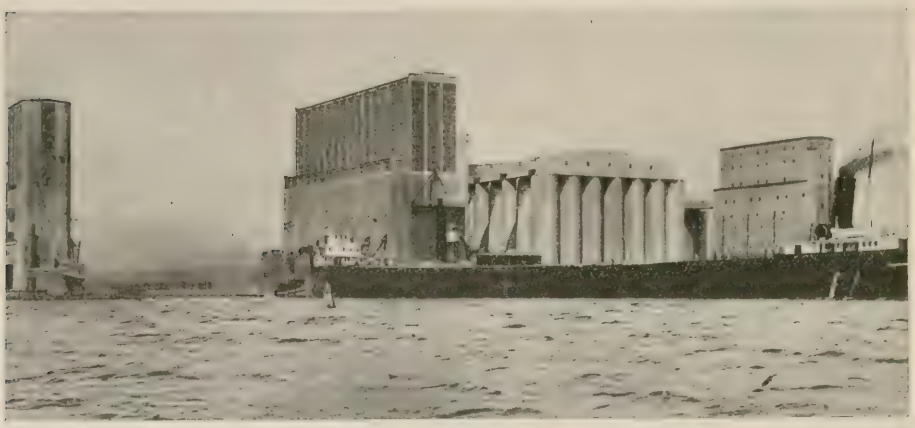
Location	Kind of Elevator	Operated by	Capacity
			bushels
Halifax, N.S.	Public	Can. Nat. Rys.	500,000
Tiffin, Ont.	"	"	2,250,000
Port Colborne, Ont.	"	Dept. Rys. and Canals	2,000,000
Port Arthur, Ont.	Public Terminal	Board of Grain Com.	3,250,000
Saskatoon, Sask.	Interior Pub. Terminal	" "	3,500,000
Moose Jaw, Sask.	" "	" "	3,500,000
Calgary, Alta.	" "	" "	2,500,000
Vancouver, B.C.	Public terminal	Vancouver Harbour Com	1,250,000

The Secretary of the Board of Grain Commissioners supplies the following information:—

"The entry of the Government into the commercial handling of grain was due primarily to agitation on the part of the agricultural interests in

* Supplied by the Natural Resources Intelligence Service.

the West regarding the operation of privately-owned terminal elevators. A public terminal elevator was built by the Government at Port Arthur, Ontario, with the following objects in view: (1) to demonstrate whether the tariff of charges in effect at privately-owned terminal elevators was excessive or not; (2) to provide the farmers of Western Canada with an absolutely government-owned and controlled elevator to which they could consign their grain; (3) to assist, in a general way, the more rapid movement of grain.



Canadian Government Grain Elevator at Port Arthur, Lake Superior.

"With these objects still in view, further elevators were erected by the Government at Moose Jaw and Saskatoon in Saskatchewan, at Calgary in Alberta, and at Vancouver in British Columbia. The erection and operation of the interior terminal elevators at Moose Jaw, Saskatoon and Calgary provided storage for eight and a half million bushels of grain, and largely takes care of the grain between the close and the opening of navigation.

"All the elevators operated by the Board of Grain Commissioners are of the most modern and fireproof construction. Up-to-date machinery is installed for the drying, cleaning, and handling of grain. These elevators are also provided with inspection and weighing facilities to the same extent as the elevators at the lake terminals, official weight and grade certificates being issued and warehouse receipts issued and registered for all grain received.

"Officers having charge of the inspection and the supervision of weighing at the Canadian Government elevators are absolutely independent of the management of the elevator system. The elevator superintendents have no more control over them than have the superintendents of any privately-owned elevators control over the Government inspectors and weighmen installed at their plants. The inspectors in each case are responsible to the chief inspector for the Dominion, and the weighmen are responsible to the chief weighmaster.

"The elevator at Vancouver, British Columbia, is really a transfer elevator, built with the object of establishing a connecting link between the Prairie Provinces and oriental markets, and in order to demonstrate the feasibility of shipping grain between Vancouver and Europe by the Panama route, it being intended that this elevator should operate for these purposes

in conjunction with the interior terminal elevators at Moose Jaw, Saskatoon and Calgary. Official weighing and inspection facilities are also provided in the Vancouver elevator.

"The objects served by the interior terminal elevators at Moose Jaw, Saskatoon and Calgary might be briefly enumerated as follows: (1) to provide facilities for meeting emergencies, which experience has shown frequently occur, affecting the grain trade of Western Canada. There have been from time to time congestions due to shortage in storage and shortage in railway cars, and there have also been seasons when, owing to the lack of drying and other hospital facilities in the grain field, there has been very serious loss incurred by the producers of grain. The interior terminal elevators were intended in the first instance to provide for such emergencies; (2) to provide a certain amount of surplus storage as near to the point of production as possible; (3) to provide a certain amount of cheap storage for local mills throughout the West, thereby stimulating the milling industries of the Prairie Provinces; (4) to provide means whereby the producers of grain in the West might have an opportunity of retaining some of the by-products of their grain in the West, thereby supplying one of the conditions necessary for the adequate development of mixed farming; (5) to give the agriculturists an opportunity of taking full advantage of all available markets, whether west, south or east, as the demand might arise; (6) to provide for the cleaning and preparing of seed grain, both for the West and for the East, special machinery being installed for this purpose.

"In addition to the handling of commercial grain, a considerable amount of specially selected seed wheat and seed oats has been handled at the interior elevators for the Dominion Department of Agriculture, the screenings from which, as in the case of commercial grain, are retained in the West, thereby rendering available to the live stock industries the necessary feeding commodities at a minimum of expense."

Port of Montreal

The port of Montreal is the interchange point between the Atlantic ocean and a system of lake and canal navigation extending inland sixteen hundred miles or almost to the eastern boundary of Manitoba, the central province of Canada. From the harbour of Montreal there is direct steamship service to practically every port in the world.

Montreal ranks first among seaports in the export of grain, shipping in 1921, in the seven months' season of navigation, 138,500,000 bushels compared with 84,700,000 bushels from the port of New York, its nearest rival, in twelve months. In the same period in 1922, Montreal delivered 154,721,505 bushels of wheat and other grains.

The present capacity of its grain elevators is eleven and a half million bushels, and an extension of 1,100,000 bushels is approaching completion. Construction is also well advanced on the first unit of a new elevator, having a capacity of 2,500,000 bushels, and work has begun on a second unit of like capacity. These new units are intended to be in operation at the opening of the 1924 season of navigation, when the total elevator capacity will be 17,600,000 bushels.

Practically from the opening of navigation until the departure of the last loaded grain vessel for sea, the elevators are in operation day and night,

unloading grain from lake vessels and from the cars of the three railway systems of the country and delivering it to the holds of the waiting ocean vessels as fast as they are ready to receive it.

The Port of Montreal. View showing Victoria Pier, with Sailors' Memorial Tower, and one of the great grain elevators. Nearly twelve hundred ocean-going vessels arrived and cleared from this port during the 1922 season of navigation.

The exports of wheat for the crop year (August 31) 1923, from the port of Montreal to the United Kingdom were 28,343,589 bushels, and to other countries, 26,032,742 bushels. In the same period the exports of wheat flour were 2,194,347 barrels to the United Kingdom and 1,511,353 barrels to other countries.

Port of Vancouver

A significant development of the last few years has been the diversion of a part of the Alberta and Western Saskatchewan crop to the Pacific coast, due to the expansion of trade with the Orient and Australasia, and the greater use of the Panama Canal route in shipping to Europe. The growing wheat exports through the Port of Vancouver give evidence of this. The year 1921 saw practically the beginning of this development when six million bushels of wheat were exported via Vancouver. In 1921-22, crop year, 7,837,171 bushels were exported and in 1922-23, 17,829,687 bushels, of which 10,506,635 went to the United Kingdom, and 7,323,052 to other countries. In the same year, 78,832 barrels of wheat flour were exported to the United Kingdom, 52,263 to the United States, and 694,696 barrels to other countries. To keep pace with growth, grain storage accommodation is being considerably augmented. The present government elevator at Vancouver—1,250,000 bushels—has been increased in capacity by 808,000 bushels, and a new ele-

vator to hold 2,000,000 bushels will be ready for use early in 1924. Other accommodation is being provided, which it is expected will bring the total up to 5,000,000 bushels in the near future.

Vancouver now has its own grain exchange to facilitate the business of buying and selling, and with greater storage and handling facilities provided, it is anticipated that an increasing percentage of the western crop will be shipped each year via this port.

Financing the Crop

The credit necessary to enable elevator companies and commission merchants to pay cash to the farmer for wheat on delivery is provided by the Canadian banks. The amount required for this purpose annually is in the neighbourhood of one hundred million dollars. By this system the farmer is not compelled to wait for a purchaser, but can dispose of his crop for cash as soon after it is threshed as he desires to do so. Having paid the farmer for his wheat at current quotations, the elevator company immediately resells through the Grain Exchange, and thus protects itself against a possible decline in values, besides keeping credit in circulation.

Buying and Selling

Wheat is purchased and sold through the medium of the Grain Exchange. The Exchange is an organization of brokers and dealers established at the principal centres to quote prices and to facilitate the business of buying and selling. The sellers are the elevator companies, the farmers' trading companies and the commission men, while the buyers comprise the millers and exporters. The bulk of the western crop is marketed through the Winnipeg Grain Exchange, which in 1915-16 achieved, and still holds, the distinction of being the largest cash wheat marketing organization existing anywhere.

THE EDITOR.

FORAGE CROP IMPROVEMENT

By G. P. McROSTIE, Ph. D. Dominion Agrostologist, Central Experimental Farm

THERE is a certain type of service which can be better performed by a community than by an individual. Such service is of the type where the cost of performing it is so great that an individual could not hope to receive sufficient benefit to recompense him for the money spent to obtain the desired result. The plant improvement work carried out by the various plant breeders of the country is obviously of the community type of service. The cost of obtaining an improved variety of any of our farm crops is usually much greater than the increased revenue derived by any individual grower from such an improved variety. However, if this initial cost is divided among the growers of a large area, the rate per grower is reduced to such a small amount that the increased revenue obtained from the improved variety in any season usually more than pays the total cost of producing such a variey.

The improvement of our various forage crops bears out the previously mentioned facts very forcibly, because most of our forage crops are open fertilized, and consequently being continually intercrossed they are much more of a mixture than is oats, wheat, or barley, which crops do not intercross to any appreciable extent. Plants which constantly intercross are more difficult, and hence more expensive to improve than are plants which do not intercross. With forage plants, therefore, the Experiment Stations, where the expense is borne by many people rather than on the individual farm, where the grower has to bear all expenses himself, is the logical place for the improvement of such crops to be carried out.

As previously intimated, the great majority of our forage crops are composed of a mixture of types, among these types will be found individuals which are low yielders and otherwise undesirable. Such individuals hold down both the general yield and quality of the crop which harbors them. There are also to be found in this same mixture individuals of high yielding capacity and of good quality. These latter tend to raise the general yield and quality of the crop in which they occur. The first problem in the improvement of forage plants is, therefore, the separation of the various mixtures into their component strains. This can most efficiently be done by repeated self fertilizations where such is possible. Reference to a particular crop will best illustrate the method of procedure: About 1911 a large number of lots of seed were collected from timothy plants found growing in different sections of Canada. All of this seed was brought to the Central Experimental Farm at Ottawa and planted out. The seed from each plant was planted in a separate row, the plants being spaced far enough apart in the row that they could be studied as individuals. As these plants approached the flowering stage, individuals of particular merit were marked in each lot. These marked individual plants were enclosed in a muslin cage that prevented any intercrossing with surrounding plants. Seed from the caged individuals was harvested and planted out the following year in the same manner as the parent plants had been planted previously.

Selection was continued with this second and with succeeding generations. The desirable plants were caged in all generations where selections were made and the progeny of each caged plant was kept separate

through succeeding generations; hence, a constant inbreeding was carried out.

The product of each successive self-fertilization became more nearly uniform until after five generations of inbreeding the original mixed selections were separated into true breeding strains.

In the course of this inbreeding process, many undesirable strains appeared and were discarded as soon as the repeated self-fertilizations had brought out their undesirable characteristics.

Desirable individual plants of timothy caged to prevent cross-pollination with surrounding plants.

These purified strains of timothy are heavier yielding and more desirable than commercial mixtures. A composite, which has been given the name of Boon timothy, of the most desirable pure strains has been grown in comparison with ordinary commercial timothy mixtures and has always outyielded the commercial lots by at least fifteen per cent.

The same general principal of inbreeding is being followed at the Central Experimental Farm in the improvement of nine (9) other types of grasses, seven (7) legume types, and also with field roots of various kinds and with corn and sunflowers. Some of these crops, as corn and sunflowers, when inbred, decrease very materially in vigor for the first few generations of self fertilization. With such types it is necessary to recombine similar desirable types in order to re-establish the original vigor of growth. The inbreeding, however, enables us to eliminate undesirable strains so that when the desirable ones are recombined the resulting mixture produces a very profitable increase over an unpurified lot of a similar variety.

The possibility of separating the component strains from a mixed commercial sample is well illustrated by the strains resulting from three years' inbreeding with sunflowers at the Central Experimental Farm. The crop grown from commercial sunflower seed probably represents as many types as it is possible to find in any lot of seed of our ordinary farm crops. The mixture sold under the name of Mammoth Russian, Giant Russian, etc., is the most commonly grown for ensilage purposes and this so called variety is no exception in the matter of being composed of a great variety of types. It was this variety that was used to

the greatest extent in breeding improved strains at the station previously mentioned. Three generations of inbreeding has resulted in the separation of strains which are remarkably uniform in height, habit of branching, leafiness, maturity and other characteristics. Another two or three generations of self fertilization will result in strains in which the various growth characters will breed true through succeeding generations.

Tripping Alfalfa flowers in one of the isolation cages used in the improvement of this crop.

Alfalfa is another crop which is being improved quite rapidly by means of inbreeding to eliminate undesirable types. A commercial lot of Grimm alfalfa has been the foundation material for the greater part of the breeding with the crop in question at the Central Farm. Alfalfa is intercrossed mostly by means of insects, hence to protect this plant from cross pollination it is necessary to prevent insect visits to it. This is done quite satisfactorily by means of large cages covered with a fine mesh wire cloth. Very little seed is set if alfalfa plants are simply caged and remain otherwise untouched. This is because insects, in visiting the plant in search of pollen or nectar, trip the flower. This tripping process consists in releasing the pistil which is held under tension and causing it to strike the keel of the flower. The stamens are carried along with the pistil and the pollen is scattered around as a result of contact with the keel. With the caged plants it is necessary in order to secure a satisfactory set of seed for some person to go inside the cage and perform this operation of tripping. An ordinary toothpick is the instrument very often used for this purpose.

After the various forage crops have been separated into their component strains or purified varieties it is sometimes found that there is still much to be done in the way or originating a variety that will be entirely satisfactory for a locality with special requirements. It then becomes necessary to build up the desired type of plant by means of hybridization.

This is frequently done in the improvement of our forage crops, although as yet the major portion of improvement work consists in the separation of our various commercial mixtures into pure strains.

The intensive research that has been carried on during the past few years concerning the morphology of plants and how their various characters are passed on from one generation to the next has opened up wonderful possibilities to the plant improver. Never in the history of plant breeding has there been a period when there was so much constructive, profitable breeding under way as at the present time, and it would seem as if the people at large could expect to receive even more value for every dollar invested in such work than they have ever received before.

AGRICULTURAL INSTRUCTION GRANT, 1923-24

WITH the conclusion of the Dominion Fiscal Year on March 31, 1923, *The Agricultural Instruction Act* passed out of existence. This Act provided for division among the Provinces of Canada of the sum of $10,000,000, during the ten-year period in which it was in operation, the object being to promote agricultural education and instruction. Under the terms of the Act, a stipulated sum was allocated to each of the provinces annually, and the balance divided pro-rata, according to population. The Act was not renewed, but for this year 1923-24, Parliament voted the sum of $900,000 to the Provinces of Canada for the purpose of assisting and encouraging agricultural instruction. The basis of distribution is the same as previously, that is to say, each province receives the sum of twenty thousand dollars, the balance being divided according to population as determined by the census, the figures being those of the census of 1921 instead of 1911. The amount granted is $200,000 less than the sum allocated in the year previous. Changes in the figures as to population have somewhat altered the proportional distribution. A comparison of the allocation of 1922-23 and 1923-24 is as follows:—

Province	1922-23	1923-24
	$ cts.	$ cts.
Ontario	336,303 26	254,001 57
Quebec	271,113 76	208,339 45
Manitoba	77,113 11	68,665 65
Saskatchewan	81,728 48	80,422 27
Alberta	66,965 62	66,937 64
British Columbia	69,199 06	61,842 92
Nova Scotia	81,716 69	61,783 51
New Brunswick	64,110 80	50,938 67
Prince Edward Island	31,749 22	27,068 32
Veterinary Colleges	20,000 00	20,000 00
Totals	1,100,000 00	900,000,00

The terms of the agreement between the Dominion and the Provinces are the same as under the Agricultural Instruction Act. The specific purposes for which the grant of 1923-24 is allotted and the amounts set forth in the Memorandum of Agreement are respectively as follows:

PROVINCE OF ONTARIO

	$ cts.	$ cts.
Ontario Agricultural College—		
Salaries and expenses	9,000 00	
Agricultural School and Farm—		
(a) Capital expenditure	$ 3,000	
(b) Administrative and teaching staff, and maintenance and equipment	49,000	
		52,000 00

Instruction and Demonstration—		
Agricultural representatives	136,000 00	
Extension work in household science	1,500 00	
Demonstrations in vegetable growing	4,000 00	
Co-operation and markets	6,000 00	
Short courses for winners of field crop and live stock competitions including travelling and living expenses	1,000 00	
Lectures on horticulture	750 00	
Demonstration work on soils	9,500 00	
Beekeeping		
Drainage work	4,751 57	
Fall Fair and Field Crop Judges	2,000 00	
Demonstrations in live stock and poultry	3,500 00	
Elementary Agricultural Education—		
To provide for and encourage the teaching of agriculture in High and Public Schools	24,000 00	
		254,001 57

PROVINCE OF QUEBEC

School of Agriculture	75,000 00	
Animal Husbandry	8,000 00	
Poultry	15,000 00	
Horticulture	25,000 00	
Dairying industry		
Agricultural representatives	60,339 45	
Seed selection		
Bee-keeping, educational work	5,000 00	
To promote teaching of agriculture in Academies, Rural and Normal schools, teacher training, school gardens and school children's exhibits	10,000 00	
To promote teaching of domestic science in Academies and Normal schools,—grants, lectures and inspection	10,000 00	
Total		208,339 45

PROVINCE OF MANITOBA

1. Field crops and Live Stock promotion	9,000 00	
2. Dairy work	8,000 00	
3. Poultry work	3,000 00	
4. Boys' and Girls' Clubs	20,000 00	
5. Home economics	8,000 00	
6. Short courses	8,000 00	
7. Soil analysis and survey	1,000 00	
8. Beekeeping	4,000 00	
9. Demonstration Farms	6,000 00	
10. Miscellaneous and Contingency	1,665 65	
Total		68,665 65

PROVINCE OF SASKATCHEWAN

Staff salaries, research and Extension Service	11,300 00	
Women's work, Homemakers' Clubs	14,974 09	
Agricultural representatives	25,774 09	
Veterinary Short Courses	500 00	
Agricultural Instruction in Public, High, and Normal Schools, Household Science, Training of Teachers, Nature Study	11,674 09	
Grants to Schools operating Departments in Household Science	4,500 00	
Expenses of officials of School Fairs	10,100 00	
Post Graduate Course in Agriculture (Agricultural Scholarships)	1,600 00	
Total		80,422 27

PROVINCE OF ALBERTA

Schools of Agriculture	20,000 00	
School Fairs	20,000 00	
Women's work	10,000 00	
Poultry extension work		
Educational work in agriculture	10,000 00	
Agricultural Representatives	6,937 64	
Total		66,937 64

PROVINCE OF BRITISH COLUMBIA

Seed work	438 00	
Silo Demonstration		
Horticultural Demonstration and Competitions	877 00	
Poultry	1,534 32	
Dairy and Cow-testing	7,897 00	
Bee-keeping	4,387 00	
Boys' and Girls' Clubs	1,096 00	
Agricultural Journal and Publications Branch	4,385 00	
Agricultural Instruction in Schools	20,614 30	
University of British Columbia	20,614 30	
Total		61,842 92

PROVINCE OF NOVA SCOTIA

College of Agriculture—		
Science Building interest and sinking fund	7,000 00	
Salaries and maintenance	23,000 00	
Agricultural representatives	5,000 00	
Short Courses	1,350 00	
Dairying	4,200 00	
Poultry	200 00	
Soils, crops, fertilizers, drainage	1,700 00	
Fruit growing	600 00	
Women's work	5,000 00	
Entomological work	5,500 00	
Elementary agricultural education	8,000 00	
Contingencies	233 51	
Total		61,783 51

PROVINCE OF NEW BRUNSWICK

	$ cts.	$ cts.
Agricultural Schools	252 57	
District Representatives	5,266 27	
Bee-keeping	1,359 55	
Soils and Drainage	944 52	
Horticulture	4,177 84	
Short Courses	2,037 45	
Live Stock	2,297 57	
Dairying	3,880 01	
Poultry	2,610 22	
Entomology	488 30	
Agricultural Societies	2,197 77	
Women's Institutes	4,670 11	
Elementary Agricultural Education	10,756 49	
Agricultural School, Experimental Farm (First Payment)	10,000 00	
Total		50,938 67

PROVINCE OF PRINCE EDWARD ISLAND

	$ cts.	$ cts.
Agricultural buildings, equipment and maintenance	1,200 00	
Director and Agricultural Representatives	4,550 00	
Short Courses	700 00	
Drainage, soils and crops	2,500 00	
Live Stock and Dairying	2,600 00	
Poultry, horticulture, beekeeping and co-operative marketing	600 00	
Women's Institutes	3,330 00	
Elementary agricultural education, Agricultural Instruction in Public and High Schools, training of teachers, allowances, grants, maintenance of rural science department, Prince of Wales College	8,600 00	
Contingencies and miscellaneous	2,988 32	
al		27,068 32

EXPERIMENTAL BEEF SHIPMENTS

SINCE the removal of the cattle embargo last spring, there has been a considerable amount of discussion as to the best methods of marketing Canadian beef animals in Great Britain, and, in order to obtain reliable data from carefully conducted and recorded experiments, the Department of Agriculture shipped a number of steers from the Experimental Farms to England last June, and the figures obtained from this experiment are now available.

The experiment consisted of making careful comparisons of the costs and returns from 186 steers collected from the Experimental Farms and Stations at Lethbridge, Alta., Indian Head, Sask., Rosthern, Sask., Brandon, Man., Ottawa, Ont., Lennoxville, Que., and Kentville, N.S. These steers were divided into five lots at Montreal, and disposed of as follows:—

Six rough steers, which were considered unsuitable for overseas shipment, were killed at Montreal and sold there as fresh beef. These averaged 1,095 pounds in weight and realized $6.30 per cwt. live weight at Montreal, or $5.65 per cwt. when shipping charges to Montreal were deducted.

Fifty fat steers, averaging 1,252 pounds each, were slaughtered in Montreal. The carcases, after being very carefully prepared, were chilled and shipped to the London market for sale as chilled beef. This beef sold in London for approximately 12½ cents per pound wholesale for hind quarters, and 6 cents per pound for fore quarters. It should be noted, however, that several factors operated against a favourable sale in this case. Large shipments of chilled beef from the Argentine had forced meat prices down generally, while the Canadian beef was not dressed in exactly the right manner to command the very highest British price. Furthermore, the necessity of shipping the meat by rail from Liverpool to London did not improve its condition.

The returns from this chilled beef, allowing for all killing, shipping, and selling, as well as revenue from offals at Montreal, showed a value of $3.93 per cwt. live weight at Montreal, and a net return of $2.96 per cwt. if shipping charges to Montreal are deducted.

Twenty-five fat steers, average weight 1,209 pounds, were shipped to Birkenhead and slaughtered immediately on arrival. These realized an average price equivalent to a value of $7.53 per cwt. live weight at Montreal, or a net return of $6.73 per cwt. after deducting shipping charges to Montreal.

Twenty-five fat steers, average weight 1,296 pounds, were sold in England as short keep stores, and realized a price equivalent to a value of $9.33 per cwt., live weight at Montreal, or $8.58 per cwt. at point of origin.

Seventy-five store cattle, average weight 1,142 pounds, sold in England as stores, realized a price equivalent to a value of $8.03 per cwt. live weight at Montreal, or a net value of $7.18 per cwt. at point of origin.

Five rough stores, averaging 1,142 pounds, were slaughtered at Birkenhead and sold there as fresh beef. These gave a return equal to a value of $7.93 per cwt. live weight at Montreal, or a net value of $7.08 per cwt. It should be pointed out, however, that this lot, being sold at Birkenhead, did not have charged against them the railway transportation from Liverpool to London, which had to be charged against the twenty-five other steers killed at Birkenhead and sold in London, mentioned in a previous paragraph.

The returns from slaughter-house by-products from steers killed at Montreal and Birkenhead furnished an interesting and illuminating comparison. While the hides, offal, etc., from the steers killed at Montreal realied only 80 cents per cwt. of live weight or $9.88 per steer, similar returns from steers slaughtered at Birkenhead showed $1.46 per cwt., or $17.49 per steer. In other words, cattle shipped to England and killed under conditions obtaining at that time realized 76 cents per cwt. more than cattle killed in Canada due to the difference in value of slaughter-house by-products alone.

The average cost of landing store cattle in England from the various Experimental Farms was found to be $42.37 per head or $3.58 per cwt. live weight, based on Montreal weights, these costs varying between $34.71 per head for the Ottawa shipment, nearest Montreal, and $50.79 per head for the Lethbridge shipment, the point farthest away.

To summarize the experiment, it may be said that, even taking into account the exceptionally unfavourable market and other adverse conditions experienced in this case for chilled beef, it is more profitable to ship fat cattle for immediate slaughter at Birkenhead than to kill in Canada and ship the meat chilled, while the most profitable method of all is to ship such cattle as meet the requirements for sale as short keep or long keep stores, although well-finished cattle, uniform as to size, weight and finish will meet a good demand if shipped for immediate slaughter.

Smooth polled, well-bred steers, sorted according to size, colour and finish, weighing from 1,000 to 1,250 pounds live weight, best meet the requirements for stores. Cattle "level in lots" sell to best advantage either by public auction or private treaty, and a thin, well-bred animal will frequently sell to better advantage than a rough, heavier steer.

The placing of a reliable foreman in charge of the shipment on the ocean voyage, to see that the animals are given proper attention, will result in better returns due to the better condition of the animals on arrival.

A pamphlet, prepared by the Division of Animal Husbandry of the Experimental Farms Branch, giving full details of this experiment, together with detailed costs and returns, is available for distribution to interested applicants.

COW TESTING

Some Herd Increases, 1920-1922

AT the Agricultural School at Oka, P.Q., the Trappist Fathers have built up a very high producing herd of Ayrshire and Canadian cows. The increase in the average production has been exceedingly rapid in the last three years, until in 1922 it reached nearly 9,000 pounds of milk per cow.

The following figures show the average production for the last three years and are for all cows recorded for eight months or longer:—

Year	No. Cows	Average Production		
		Milk	Test	Fat
		lbs.	per cent	lbs.
1920.....	44	6,733	3·83	257·7
1921.....	43	8,806	3·79	334·2
1922.....	46	8,901	3·88	346·0
Average increase per cow		2,168		88·3

In 1920, there were eleven cows in the herd which produced 300 pounds

fat or over; while in 1922, 30 cows, or over 66 per cent of the total cows in the herd, produced over 300 pounds fat. The average for the 10 best cows in 1922 was 10,811 pounds milk and 409 pounds fat.

At Blenheim in Kent County, Ont., C. E. Rowe has also shown that persistent and intelligent use of dairy records will help to increase milk production. The following table shows the results obtained during the past three seasons:—

Year	No. Cows	Average Production		
		Milk	Test	Fat
		lbs.	per cent	lbs.
1920	10	7,488	3·29	246·5
1921	11	8,464	3·39	287·5
1922	11	10,235	3·38	346·4
Average increase per cow		2,747		99·9

In the case of the herd of Mr. Rowe this increase in production amounted to nearly 1,100 pounds butterfat for the year, which, at 35c. per pound butterfat, would be worth $385. This increase in income would be very nearly all extra profit as the size of the herd was not increased.

Increased production per cow is a possibility in every herd in Canada if the owners will take stock of each individual cow's production and then eliminate the poor producers.

New York State Results

The last monthly report of the New York State cow testing associations gives some interesting figures on the progress made in milk and fat production. In 1921, the average production of all cows in eleven associations was 6,403.3 pounds milk and 235.29 pounds fat. In 1923, all yearly records for sixteen associations show an average production for 2,480 cows of 7,257.3 pounds milk and 261.3 pounds fat. This is an increase of over thirteen per cent in milk production and eleven per cent in fat production in one year. The average milk production for New York State is given as 4,267 pounds milk. The advantage of belonging to a cow testing association is very evident from these figures.

If the average production of Canadian cows were equal to that of the New York cow testing association cows, Canada could produce the same quantity of milk with very few more than half the present number of cows, and the amount of labour, feed, time and money saved would make an inconceivable total.

IMPORTATION OF NURSERY STOCK

ON September 1, 1923, new regulations under The Destructive Insect and Pest Act went into effect. Importers of nursery stock, which includes all plants for ornamental purposes or propagation, but not seeds or seed potatoes, are hereafter required to secure a permit from the Secretary of the Destructive Insect and Pest Act Advisory Board, Department of Agriculture, Ottawa. The permit must be filed with the Collector of Customs at the port of entry.

All importations of nursery stock must be accompanied by a certificate of inspection issued by an authorized official in the country of origin stating that the stock is apparently free from any disease or pest within the meaning of the Act.

Nursery stock originating in any foreign country other than the United States of America, shall be imported only through the following ports, and may not be transmitted through the mails: St. John, N.B.; Montreal, Que.; Ottawa, Ont. (for scientific purposes

only); Niagara Falls, Ont.; Vancouver, B.C.

At these ports shipments shall be reinspected, or they may be allowed to proceed to their destination for inspection. All shipments from the United States consigned to residents of the province of British Columbia must be forwarded to Vancouver for reinspection.

The importation of a number of plants and fruits is prohibited from certain countries and from certain of the United States of America, on account of insect pests and plant diseases.

THE SEEDS ACT, 1923

THE Seeds Act, 1923, with regulations thereunder, effective from October 1, 1923, will replace the Seed Control Act, 1911, which had compulsory grades for timothy, red clover, alsike and alfalfa seeds, and voluntary grades for seed grain and other seeds.

The new Act requires that all grass, clover and other field seeds, excepting root and vegetable seed, must be graded when sold for seeding. Farmers, however, are exempt from grading cereal grains, buckwheat, field peas and beans, and corn when sold on their own premises for seeding by the purchaser himself.

Dominion seed laboratories for the testing and grading of seeds are available at Calgary for Alberta and British Columbia, Winnipeg for Manitoba and Saskatchewan, Toronto for Western Ontario, Quebec for that province, and Ottawa for Eastern Ontario and the Maritime Provinces. A farmer or seedsman may have ten samples tested free of charge if received during January and after May 1. Testing samples for the control of the seed trade occupies the full time of the laboratory staffs during February, March and April.

Copies of the Seeds Act, 1923, may be had on application to the Publications Branch, Department of Agriculture, Ottawa.

FRUIT DRYING PROJECT

THE plant at Grimsby, Ontario, for the dehydrating of fruits, lately established by the Dominion Department of Agriculture, began operations on a commercial scale this fall, after conducting preliminary experiments with satisfactory results. Chiefly peaches, plums and apples are being dealt with. This undertaking, which is the first of its kind in the Niagara District, is likely, it is believed, to lead to important developments in the direction of supplying consumers with native products in place of those now being imported.

The dehydration plant established this season in the Okanagan Valley, B.C., was destroyed by fire shortly after beginning operations, and further experiments will have to be deferred.

At the Central Experimental Farm, Ottawa, dehydration experiments have also been in progress during recent months with sour cherries, strawberries and other small fruits, the work being performed under the supervision of Mr. J. H. Robinson, chemist.

PART II

Provincial Departments of Agriculture

SOME PATHOLOGICAL PHASES OF BOVINE REPRODUCTION

By ALFRED SAVAGE, Animal Pathologist, Manitoba Agricultural College

SUCCESSFUL and continued reproduction is the foundation upon which all the animal industries are built. The process is of vital importance not only to stockmen, farmers and the meat consuming public, but also to dairymen, packers and the manufacturers who produce that immense diversity of animal products which civilized man uses in the course of his every day life.

Abnormalities of reproduction are most noticeable and cause the greatest losses under two conditions:

1. Where the reproductive process is most intense, and
2. Where the capital invested is largest.

For these reasons, and because the animals require almost incessant attention, they have been studied most in the case of dairy cattle, the products of which, calves and milk, are purely sexual. Some intensely interesting and profitable work has been done on the pathology of reproduction in horses, sheep, swine and dogs, but space forbids even the attempted discusssion of so large a subject where more than one species of animal is concerned.

Before one can speak intelligently on the losses due to abnormal reproduction, it is necessary to have a standard by which they can be measured. Happily this has already been fixed, and I can do no better than quote Williams[1], its originator.

"Breeders are not in perfect accord regarding the age at which it is best that a heifer should calve. In my writings[2] I have adopted two years as the ideal age, which necessitates conception at fifteen months. I have designated as "breeding months" each calender month after the fifteenth. The idea is assumed that after the fifteeenth month in the life of the animal, she shall produce one calf each twelve months, and that in order to do this, she shall be pregnant nine, and non-pregnant three in each twelve months (more accurately she should be pregnant 9.3 months and non-pregnant 2.7 months or 282 days and 83 days respectively). If the age of the animal is determined in months and the fifteen months prior to breeding age deducted, the remainder gives the total breeding months for the heifer or cow. If the total breeding months of the animal's life be divided by the number of calves born, the result will represent the average number of months required to produce a calf. In this scheme abortions are omitted and one may, if desired, omit or class separately, premature or diseased calves. If the ideal number of twelve months for the production of a calf be divided by the actual number required, the result will represent the reproductive efficiency attained by the animal. If, for example, an animal produces upon the average one calf each fifteen months, then the equation would be $^{12}/_{15}$ x 100, or 80 per cent efficiency. The efficiency of the entire herd is readily obtained by determining the

sum total of the breeding months of all cows and heifers in the herd and dividing this by the total number of calves born, the result being the average number of months which the cows and heifers have been kept in the herd in order to produce a calf. In this calculation all heifers over fifteen months old are to be included. In calculating the efficiency of a cow up to a given date, it is essential to take into consideration her breeding condition at the time. If pregnant six months, the duration of pregnancy should be regarded as equal to two-thirds of a calf less any deduction suggested by the prevailing rate of abortion in the herd."

For the benefit of those who have not gone into the subject of breeding efficiency seriously and, in consequence, have rather nebulous ideas concerning the usual reproductive performance of herds it should, perhaps, be stated that the highest figure found by Williams[3] was 75 per cent of the ideal. This writer also states that in all the data assembled by him on this subject, the average efficiency has fallen below 60 per cent; in some herds it was below 30 per cent.

In order of their importance, the main reasons why breeding efficiency of individuals and herds falls so short of the ideal, when considered over a period of years, are as follows:

1. Sterility;
2. Diseases of the New Born;
3. Abortion.

This statement may easily be checked by observation. It is supported, at least insofar as the relative position of the first item appears, by Albrechtsen[4], Miller and Simms[5], Groome and McCoy[6], and other writers of practical experience.

The trinity of reproductive failures just enumerated has nullified some of the finest pedigrees ever reared by man: it has ruined many a breeder and doubtless spoiled more than one genetic experiment. And the worst of it is that while these disorders occur wherever there are cattle, the conditions best favouring their continuity are too often found in high-grade herds of pure-bred stock. Viewed from this angle, Thomas Bates' historical Duchess strain of Shorthorns furnishes some interesting material for reflection.

Abortion

The premature birth of a dead calf, say at about mid term, accompanied by the expulsion of a few gallons of pus and followed by retention of the fœtal envelopes is a sufficiently alarming event to attract attention anywhere. It is the most obvious reproductive failure. For this reason abortion was the first topic of the kind to receive serious study.

Nocard's Work.—In 1885 Nocard[7] attacked the subject. He examined fourteen aborts, noting that the intestinal canals contained a number of microbes and that the cadavers showed a marked tendency to putrify. He observed the altered condition of the fœtal membranes, the presence of pus in the uterus and commented on the accompanying metritis. This last he did not consider primarily responsible because, in sections made through the uterine walls, he observed only an epithelial desquamation.

From the exudate in the utero-chorionic space he obtained cultures of two organisms, one a micrococcus, the other a rod. Apparently the same coccus was obtained from the amniotic fluid of other cases, and in one instance, from the medulla of a fœtus. He considered this and the main agent responsible but, so far as I can ascertain, did not recommend any definite prophylactic or curative measures based on that assumption. His work was not further pursued and does not seem to have attracted very much attention at the time of its publication.

Bang and the Abortion bacillus.— Bank and Stribolt[8] in 1895, slaughtered a cow showing "the well known premonitory symptoms of abortion" and examined the entire pregnant uterus. They noted abnormalities in this organ and edema of the fœtal membranes. From the exudate in the utero-chorionic space they isolated, in pure culture, a decidedly peculiar organism now known as they originally designated it, *Bacillus abortus.*

These investigators subsequently infected, *per vaginam,* two pregnant cows obtained from sources where abortion was allegedly unknown. One of the animals aborted; the other was killed. From the uteri of both the same bacillus was recovered, but in one case, other organisms were also present. The conclusion drawn from these two cases cannot be passed over lightly: "*By both these experiments we have furnished the complete proof that the bacillus discovered by us is the cause of epizootic abortion.*"

Some very pointed criticism may be levelled at this statement. For example, such unqualified use of the definite article *the* is unjustifiable, and as only cows were under consideration the word *epizootic* is not warranted. Further, we are told nothing about the bull nor about the state of the cows' genitals, so it is questionable whether the animals would not have aborted in the usual course of events. This is set forth in detail because Bang's statement, as given above, has dominated the struggling science of veterinary gynaecology for a full quarter century.

Bang further stated that the "disease" is followed by a certain amount of immunity and, among other measures, suggested its control by the use of biological agents.

The Growth of "Orthodoxy." For the time being, Nocard's work went to the wall. That of Bang lay practically unnoticed for about ten years and then there was a revival. The Bang organism was isolated in England in 1909[9], in America the following year[9], and very subsequently in most of the civilized countries of the world. Inasmuch as it has never been found associated with other than infected animals, and in view of Bang's conclusion, this bacillus worked itself into a position of monopoly. It became accepted and recognized as *the* cause of bovine (if not epizootic) abortion, and as such has occupied a unique place in the whole realm of bacteriology. It would be an impossibly large task to review all the literature bearing on the facts and theories of this dogma, but the main points can be set forth as follows:

Facts. The abortion bacillus is widespread, undoubtedly pathogenic for some species of animals, and is very commonly associated with bovine abortion. It has been found in the uteri of pregnant cattle, where it usually accompanies a suppurative metritis. It may occur in various parts of the fœtus and its coverings. as well as in the fœtal bloodstream. Usually, after parturition or abortion, it disappears from the maternal uterus in from two to six weeks. For this reason it is maintained by many that it induces the specific metritis of abortion and few, if any, other lesions. Its presence in the pregnant uterus does not always induce abortion.

It has also been recovered from the mammary gland where, peculiarly enough, it seems to have the faculty of remaining for months without producing any visible lesions. The same statement holds true for the adjacent lymph nodes. Fairly recently it has been recovered from

the seminal vesicles of bulls[10] and in one instance at least[10] from a testicular abscess.

Owing to the specific blood reactions induced by infection with this bacillus, its presence in an animal may be diagnosed by the agglutination and complement fixation tests[11, 12].

While the above are pretty well established facts, there are several unproved but widely accepted statements that form part of the orthodox creed. The first of these is that if a healthy pregnant cow eats infected material, she will probably abort as a result[13, 14, 15]. The second, based on Bang's assertion, is that animals may become immune to the "disease," either naturally or artificially[8, 15]. Another seems to place the male animal on a plane apart from the rest of his species for it credits him not only with a "sex immunity" but a minor role in the spread of the "disease"[15]. And there are other beliefs of less importance.

Some Objections to "Orthodoxy." —Now this whole collection of opinions, theories and statements to which I believe he first applied the expression "orthodox," has been almost ceaselessly attacked by Williams[16] for the past ten years. As will be indicated presently, the activities of this investigator have been eminently sound and constructive, so sound in fact that he could not admit much of orthodoxy because it remained unproven. With him observation comes first, reflection second, and speculation hardly at all. And the accepted orthodox creed does not always fit in with the whole truth.

To begin with, there is the fundamental question, "How much etiological relationship does the Bang organism bear to abortion in cattle?" In answer to this, Williams[17] summarises and tabulates all the available records of experimental attempts to produce abortion, during an existing pregnancy, with the *B. abortus*, comparing them with direct and indirect controls. In conclusion, while not denying that the organism may be harmful and may even be a cause of abortion, he states "*It has not been clearly shown that a like number and kind of pregnant cattle would not have aborted had sterile salt solution been substituted for the Bang organism.*" The figures given certainly both permit and support that statement.

Next, there is a consideration of the control measures based on the assumption that Bang's organism is the specific cause of "contagious abortion." Williams has criticised these in at least two ways, which it is convenient to call positive and negative. His positive criticism begins by denying the existence of immunity to the act of abortion. Any female capable of becoming pregnant is potentially capable of aborting. That is obvious. Then he denies the probability of an immunity against infection with the *B. abortus* on the ground that such infection is by nature essentially chronic, and that successful immunity against bacterial invasions of this class is unknown. In this contention he is supported by Ascoli[18] who, working with laboratory animals, has shown that the alleged immunity to Bang's bacillus is merely increased toleration of its harmful effects.

A second criticism concerns attempts to produce immunity by the use of sera, bacterins, cultures, etc. A study of published results following the injection of biological agents shows clearly that both dead cultures of *B. abortus* and 'immune serum' are almost universally condemned as valueless for the prevention of abortion. The use of living cultures, however, is still being widely advocated by many. A peculiarly mis-

leading feature in this connection is that, following the injection of live organisms, the actual abortion rate is often lower in the test animals than in the control group. At first this seems to vindicate the whole orthodox scheme of things. Such is not the case, however, because, as Williams[19] has pointed out, the decline in actual abortions is nearly equalled by an increase in the occurrence of sterility, so that the resultant breeding efficiency is very little improved. Indeed, the procedure is, to say the least, highly questionable. It furnishes another example of "Out of the frying pan, into the fire."

By way of comment one is tempted to add that the effectiveness of successful vaccines has been recognized without delay, that is if those in use for the prevention of anthrax, blackleg and rabies may be considered examples. The 'vaccinationists' have been working at 'contagious abortion' for decades. Thus far they have not produced a convincing or well recognized result.

As negative criticism Williams states—"It has not been determined what, if any, effect upon the reproductive efficiency of a herd the elimination of *Bacterium abortus* infection would cause." This brief sentence represents the economic essence of three instalments by M'Fadyean[20].

Heresy.—Now for some heresy, and the term is used in the sense that it denotes fundamental differences.

Albrechtsen[21], a Scandinavian practitioner, noted that in many of the herds under his supervision it was impossible to obtain the specific blood reactions that indicated the presence of *B. abortus;* nevertheless breeding irregularities, including abortion, were rife.

The Spirillum of McFadyean, Stockman, Smith, et al.—In 1919, Stockman[22] called attention to a *vibrio* which he and McFadyean had isolated in connection with abortion in ewes more than six years previously, and which had been associated with at least three outbreaks of bovine abortion in Great Britain.

Theobald Smith[23] subsequently isolated what is now recognized as the same organism in America in 1918. Of 41 abortions in a certain group of herds, he identified 14 with this spirillum and 27 with the *B. abortus.* He also noted the presence, in some instances of colonoid bacteria.

Two years later, in collaboration with Little and Taylor[24], he published an account of 26 abortions in one herd, all, with one exception, seemingly due to this spirillum. The exception was associated with *B. abortus* in addition. As a check on cultural methods used in this work, agglutination tests were made on both blood and milk. All the animals were in their second or later pregnancies.

Axel Thomsen[25] also reports the recovery of this vibrio in four out of eleven cases of abortion.

The Paratyphoid Organism of Moussu.—Moussu[26], in 1914, reported the extensive occurrence of bovine abortion in France due to an organism of the colon-typhoid group, the *B. abortus* being absent.

Other Microbial Causes.—Tuberculosis of the pregnant uterus has been given as a cause of abortion by Bang, Axel Thomsen[25] and Williams; and it is interesting to note in passing that not only has Carpenter [27] catalogued a variety of bacteria isolated from a study of more than 50 aborts, but also that Theobald Smith has described an invasion of the fœtal membranes by a mould of the genus Mucor.

Williams and Modernism.—These discoveries do not fit in with the orthodox scheme of things at all, but in view of their existence, one seems

almost compelled to admit the worst 'heresy' of all, namely that of Williams[28]. Having defined the position of the "true believer" in this matter he states:—

> "The second group, to which the writer belongs, holds that abortion is not a specific contagious or infectious disease like glanders or hog cholera. On the contrary, it is held that any infection resident in the cervical end of the uterus, or which may, during pregnancy, invade the uterus, may, amongst other results, cause abortion. According to this view, there are two essential factors in the causation of abortion: the infection must destroy the life of the fœtus and must arouse such irritation of the uterus as to cause it to contract and expel its contents. Any infection capable of bringing about these two conditions may cause abortion, be it the streptoccus of Nocard, the colon organism of Moussu, the vibrio of McFadyean and Stockman, or the spirillum of Theobald Smith."

It is a long way from the view of Bang to that of Williams. It is a way which, once taken, permits of no return journey. Because it is in perfect accord with all the present facts of the subject and permits the future discovery of an unlimited number of "abortion organisms," I have called this attitude *modernism*.

Sterility

To avoid misunderstanding, it should be stated clearly that sterility is not a disease. It is simply failure, after mating, to produce a visible (or observed) fœtus. Strictly speaking, one should distinguish perhaps between failure to achieve fertilization and early death of the fertilized ovum. Practically, this is not often possible. Many early abortions occur unseen or unrecognized. They constitute sterility as one ordinarily meets it; so, largely for this reason, the heading occupies first place in the list of reproductive failures.

Sterility may be due to many causes, the commonest of which is infection. This infection is not specific and may invade both males and females. Giltner and Bandeen[31] have shown that, normally, "there is a general relationship between the flora of the generative mucosa of the two sexes". Udall Cushing and Fincher[32] reviewing 48 cases of sterility in cows that came under their care, state: "This group gives no support to the frequently expressed opinion that 'Bang's disease' is the chief primary cause of diseases included under the term sterility—that *B. abortus* introduces other infection and then shortly retires."

But infection, to be capable of resulting in sterility, must produce lesions. It does, and these are subject to variation according to the sex of the animal and the part involved. It would be profitless at present to do more than touch upon the commoner of these. They, however, are of great importance.

By far the most outstanding genital lesion interfering with reproduction in cows and heifers is a chronic inflammation of the uterine neck or cervix. It underlies abortion. Alone or associated with other lesions it is responsible for most cases of sterility. One practitioner—Lothe[33]—stated that this condition was responsible for 70 per cent of 500 sterile females treated by him.

In cervicitis the anatomical features of the part predispose chronicity. The passage is long and tortuous; the mucosa thrown into well developed circular folds. As a result the part becomes first inflamed, then deformed and finally indurated. These fairly definite stages follow one another slowly and present a variety of

appearances according to circumstances. Sometimes, when the part is exposed with forceps, there is little to see at first: the lesion is at the anterior or uterine end of the passage. In many instances there is protrusion of the second annular fold of mucous membrane through the external os; in others a hidous distortion, suggesting in appearance a small red cauliflower.

When not of too long standing, and unaccompanied by other and inaccessible lesions, cervicitis offers a fair chance of recovery under proper treatment. That treatment consists fundamentally in the use of suitable antiseptics applied directly to the diseased mucosa. Pure Lugol's solution (U.S.P.), silver nitrate in varying concentrations, and even 30 per cent formaline in water, have been used for this purpose. If they fail and the animal's value warrants such procedure, the cervix may be amputated, though this operation is one for experts only.

Uterine lesions are common enough. They vary, over a long scale, from startling accumulations of pus to chronic atony of the part, and include some conditions of great pathological interest, particularly those described by Hallman[34]. The organ is not as accessible as the cervix, however, and hence, though it may be palpated and massaged 'per rectum', and even in spite of its great inherent powers of repair, is not as satisfactory to treat. Lothe reports 55 per cent recoveries from 227 cases of endometritis.

Abnormalities of the Fallopian tubes and pavilions, unless well developed, can, as a rule, only be recognized when the examiner has a delicate and educated sense of touch. They offer no chance of recovery under present methods of treatment.

The ovaries are subject to many pathological changes, not all of which are by any means understood. Among the most interesting fields for research are those concerned with the ductless glands, and a large part of the ovarian function is ductless. Perhaps when the inter-actions of the *Corpus Lutem,* the ovarian stroma and the rest of the female tract are more thoroughly understood, one may speak with safety concerning them. Here, as elsewhere, pathology is forcing the pace for physiology and the ground is a too contentious one on which to tread heavily. For this reason no more will be said at present than that retained *corpora lutea* (inhibiting estrum) can be expressed 'per rectum' or 'per vaginam,' and that the glands in question are surgically accessible. So much for the female.

Bulls.—The role of the male animal in sterility, abortion and other breeding losses received little serious attention until comparatively recently. Even then it is to be regretted that some otherwise excellent work on the subject was apparently so steeped in orthodoxy that it became a search for one particular organism—*B. abortus*, rather than an unbiased study of material and cases. Thus Schroeder[35], in 1917, isolated the Bang organism from a chronic epididymal abscess in a bull. Two years later, Buck, Creech and Ladson[10] found the same bacterium in the seminal vesicles of four bulls and in a testicular abscess of another. Possibly because of the rarity of this site for such "specific" infection, breeders were led to believe that the bull was not a very big factor in the spread of "contagious abortion." But things have changed.

In 1920, W. W. Williams[36] published an account of the genital examination of eight bulls that were sexually unsound, together with case histories and a description of his methods for collecting and examining the semen of these animals. Aside from inflammation of the penis, testes

and epididymis, this worker described clinically recognizable spermatocystitis as a fairly common condition. He also noted the abnormalities to be found in a microscopic study of the sperms themselves thus opening a new and fascinating field of research. Incidentally, too, he identified a number of bacterial invaders in the fresh semen of his patients. These were pathogenic staphylococci, *S. viridans*, and paracolon bacilli. Somewhat similar findings have since been reported by Gilman[37] and by Groome and McCoy[6].

The entire subject of miscellaneous and specific infection of the male genitals of cattle has been systematically dealt with by W. L. Williams in his volume on the "Diseases of the Genital Organs of the Domestic Animals"[29], while very recently this same author has published a most convincing paper on the "Male as a Spreader of Genital Infections"[38]. The evidence given in this contribution is without flaw and irrefutable. It should be broadcasted. While officials hesitate in the matter, let me state the essence in two quotations. "*The thoughtful student . . will frequently find evidence which indisputably proves that the male is a potent factor in ruinous diseases interfering with reproduction.*" And — "*The breeder needs as early as possible to free himself from the centuries-old tradition that females have genital infections or "female complaints" in which the male may not participate.*"

A minimum of reflection on that point will show that, by means of the bull, every cow in a breeding group is exposed to the genital infections of every other cow in the same group. The larger the number of females allotted to each bull, the greater that exposure becomes and danger increases accordingly. Thus when, as in the case of many good sires, the bull is physiologically overworked, used on cows from several stables, or follows other bulls on cows that are "hard to catch," it becomes fairly obvious how abortion storms occur and breeding difficulties are rife, not only in many pure-bred herds but, in a number of instances, where community bulls are maintained.

Diseases of the New-Born

Modernism, however, includes much more than a broad conception of breeding losses due to abortion. It definitely links them up with those due to sterility and calf mortality, substituting them as different manifestations of the same thing (genital infection) for what would, under the old regime, constitute entirely separate subjects.

Thus Williams[29] again: "It is denied as a principle that conception, parturition, birth or other physiologic act draws across the path of life an impenetrable barrier to disease. It is held that any infection competent to invade a female may likewise invade a male; if able to invade a pregnant animal, it may also invade the same animal non-pregnant; if it can gain a habitat in the pregnant female, it may persist after parturition; if it can invade and imperil the life of an embryo or fœtus, it may continue through birth and affect the new-born, or may attack the new-born from external sources."

Or, as Hopper[30] has put the same idea. "If fertilization does occur, death of the resulting union may come at any time. *First:* because conditions may be such, due to a certain degree of infection or change, that the embryo perishes at an early date while still microscopic in size. *Second:* death of the fœtus at any time, without immediate expulsion, resulting in decomposition, maceration, excessive formation of pus or mummification. *Third:* expulsion of the fœtus or embryo at any time prior

to the normal termination of pregnancy. *Fourth:* fertilization followed by a living but weak calf. *Fifth:* a living calf, normal parturition, followed by death of the calf in from 12 to 24 hours from septicaemia. Clinically, then, we have all stages of non-production. I do not see how we can draw any conclusion as to where premature birth or death of the fœtus begins or where it ends."

I do not quite understand the last sentence. Admittedly, an animal may die before or after birth and be born after or before death. Verbal shuffling does not matter, however, so long as the criterion of successful mating, live healthy calves, is not lost to sight.

The paragraphs just quoted represent not only the opinions of clinicians; they are supported in large measure by the bacteriological findings of Giltner and Bandeen[31], Carpenter[27], Hagan[29], and some others.

In its effect upon the fœtus, only one result of infectious uterine disease has been considered—death before parturition. That is bound to occur if the causes operating to produce it are highly virulent and do not require much time in which to act. But the causes are not bacteriologically specific and differ in virulence even as calves vary in vitality. Hence it is quite reasonable to suppose that a fœtus may be infected before birth and live through parturition only to die afterwards of septicaemia "white scours" or pneumonia. Practically, however, this is more than a supposition.

There are two main reasons why the above mentioned infections of the new born must be considered as breeding losses. Firstly, they are commonest in herds where sterility, abortion, retained placenta and other irregularities of such nature abound. Second, there is strong evidence that they are caused by essentially the same organisms. These points require little elaboration.

It has been indicated by Williams and Carpenter[39] that infection from pregnant uterus to its contents occurs in the following order: first the utero-chorionic space; second, amniotic and allantoic fluids; third, the fœtal bloodstream. In the particular research to which reference is made, the alimentary tract was not cultured. But *sucking* movements of the fœtus can be detected, under suitable conditions, when pregnancy has been established six or seven months. *Swallowing* is proved to have taken place by the presence of hair in the meconium of calves born normally. The obvious conclusion is that a fœtus swallows the fluid immediately surrounding it, thus exposing its digestive tube not only to floating hairs but to whatever infections happen to exist within the amniotic sack. In a later publication, Williams, Hagan and Carpenter[40] state: *"We have found thus swallowed colon bacilli, streptococci, staphylococci, micrococci and B. abortus."* In view of this, there is no reason why a calf, suitably infected, might not scour itself to death before, during or after parturition.

To consider calf scours as purely the result of an infection contracted in utero, would be as unreasonable as thinking "contagious abortion" a "specific infectious disease of the pregnant female." No such thing exists. Scours, and that is representative of the whole group—indeed there is no sharp demarcation between them —may also be contracted after the animal is born. The writers just mentioned stated that, from their observations, other common means of infection are provided by—

1. The genital discharge from the dam—thighs, udder, escutcheon;

2. Feeding sound calves from unsterilized utensils previously used by diseased ones;

3. Cohabitation, via bedding, stalls, fittings, etc., and directly.

These diseases are highly fatal. Even when handled energetically and promptly, the results, while encouraging, are far from perfect. But therapeutics is without the scope of this paper and, even now, we are considering post-natal conditions of a highly contentious character.

There is a further point in this connection which commands attention. It is the influence of the calf's health upon its fertility when breeding age is attained. That there should be much, if any, connection between them sounds highly improbable at first. There seems to be a very direct relationship, however, which is both interesting and important for it further links diseases of the new born to other breeding losses, though in this instance, the losses occur in the next generation.

Evidence is scant but definite. It seems to be limited to two herd studies by Williams[41, 42], which can easily be outlined in brief. In the first of these herds the calves were born of genitally infected cows and raised under filthy conditions for six successive years. As heifers in their first pregnancy such calves aborted at the rate of about 50 per cent. Sterility was high. Conditions were then changed and a hygienic system of calf raising followed. Heifers brought up under the new regime and bred to essentially the same herd bulls aborted at less than one-sixth the previous rate—8 per cent.

The second herd furnished material for a numerically large study lasting seven and a half years. It was tubercular and cursed with genital infections which manifested themselves in every form. In the 40 months under review 593 heifer calves were born of which only 170 eventually conceived. Of these 95 calved; 75 aborted.

At the close of this period, certain changes were made. Among them were the institution and proper use of maternity stalls; the feeding of pasteurized or at least heated milk; the avoidance of crowding. During 50 months of this improved practice, 904 heifers were born, 382 of which conceived. Of the latter, 203 calved, 22 aborted and 157 were pregnant at the time of writing. Commenting on this Williams writes—"The most striking difference between the behaviour of the two groups of calves when they reached breeding age is in the rate of abortion. In the first group 55·9 per cent calved and 44·1 per cent aborted; in the second group 90·2 per cent have calved and 9·8 per cent have aborted. We have been unable to find any explanation for this change in the rate of abortion except the method of feeding the heifer calves."

At this point it is interesting to note what the Departmental Committee of the British Board of Agriculture and Fisheries had to say on the subject in 1905. Considering *epizootic abortion as it occurs among bovine animals* the Committee's report states with reference to infection by way of mouth—"In fact we are inclined to believe that the disease is more frequently contracted in this way than in any other." The committee was, of course, strictly orthodox, but the point is one on which the two are singularly in accord.

Control of Breeding Losses

This is scarcely the place to discuss control measures for breeding losses at any great length; still the preceding would be futile if some practical lessons could not be learned from it. Two such lessons stand out. One is that *orthodoxy* of the old type has not justified its existence. Practically it has failed to appreciably raise

breeding efficiency; theoretically it is narrow and does not admit all the facts. We predict its death.

The other is that if a genitally unsound animal of either sex is bred or, worse, if two such animals are mated, one cannot logically expect a sound result. Whether that result will be sterility, abortion, a still birth, infected calf, retained placenta, fatal metritis, or something else, it is nearly impossible to predict.

The avoidance of all these failures depends upon adherence to two simple rules propounded by Williams[43] some years ago and already touched upon:—

1. Mate only genitally healthy adults;
2. Guard the health of the new born.

These two simple statements are the essence of sanity in breeding matters. Their application, however, is not so simple. To begin with there is the question of how to determine genital health when animals have attained breeding age. If the genitalia were all external, perhaps it would be easy, but they are not so and, therefore, an expert consultant is required. It becomes the duty of this veterinarian when examining a herd to pick out (1) animals fit and ready to breed, (2) those requiring medical or surgical treatment, and (3) those whose reproductive capacity is lost. Group three should be promptly got rid of. Animals in group two must be given such treatment as will fit them for group one or discarded.

An inspiring illustration of the effectiveness of this procedure has been given by W. W. Williams[44]. In 1917 he undertook supervision of a large dairy herd which was saturated with both genital infections and tuberculosis. It was decreasing numerically at a fast rate. During that year only 53 per cent of the females became pregnant, and of these 62·3 per cent calved, 37·7 per cent aborted. After three years of highly instructive effort, a herd inventory showed that conceptions stood at 85 per cent, calvings at 90·4 per cent and abortions at 9·6 per cent. During this time the average number of breeding females had decreased 14 per cent, but the calves and heifers under breeding age had multiplied by three. There is no record which begins to compare with this.

The second point, concerning the health of the calf, has already been dealt with sufficiently. Its bearing upon life and subsequent reproduction is of the greatest importance to breeders.

If one may draw any conclusion from all the work published on this and kindred subjects to date, it is that common sense, competent supervision and close co-operation between the breeder and his veterinary adviser seem to afford the only avenue of escape from one of the greatest menaces to the whole cattle business.

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A VISIT TO BRITISH SHOWS, FLOCKS AND HERDS

By J. G. ROBERTSON, Live Stock Commissioner, Saskatchewan

MY services having been lent by the Department of Agriculture to the Saskatchewan Sheep Breeders' Association and the Saskatchewan Swine Breeders' Association for the purpose of selecting and assisting in the purchase of breeding animals for the members of these Associations, I spent a couple of months in Great Britain this summer, and was able to attend most of the larger live stock shows as well as to visit many of the important breeders of sheep and swine.

This opportunity to secure new blood for our flocks and herds occurred through the offer of the Dominion to help, financially, in the im-

portation of rams and boars under certain conditions. Saskatchewan was the only Western Province to respond, but the four largest Eastern Provinces also aranged to make importations. The great success of a small importation of Shropshires by the Saskatchewan Sheep Breeders' Association in 1920 made the Saskatchewan breeders very anxious to grasp the present opportunity; and it is expected that good results will be obtained from this new purchase in the course of time; new blood having been secured in Shropshire, Oxford and Border Leicester sheep and in Yorkshire, Berkshire and Tamworth swine.

British Shows

The writer accompanied Mr. McLauren, Mr. O'Neill and Mr. McEwen in a visit to several of the larger shows including The Royal Counties Show at Southampton, The Three Counties Show at Malvern, The Edinburgh Show, The Highland Show at Inverness, and The Royal Agricultural Show at Newcastle.

A Canadian is impressed first of all at these shows by the fact that they have no permanent equipment. Shows are held in different locations each year, and live stock and machinery are housed under canvas during the period of the show. There are no walks other than the natural turf. Yet, in spite of this arrangement, the live stock is comfortably housed and there is practically no mud in the show yard. British shows have no midway attractions, so that the interest of the people who attend is concentrated upon the live stock and machinery exhibits.

All classes of live stock are judged upon the first day of the show, and exhibitors are compelled to display a card over each animal showing what he has won in this particular show. Horses and cattle are paraded daily after the first day. These parades are very well managed, very fine, and attract a great many people into the grandstand. Following the parades, the classes of jumpers are judged in front of the grandstand, and these classes to a certain extent take the places of the automobile races frequently run off at Canadian shows. The system of charging a high admission fee on the first day of the show and decreasing amounts each following day appears rather odd to one accustomed to the Canadian system. For example, at The Royal the admission on the first day of the show is ten shillings, on the second day five shillings, on the third and fourth day three shillings each, on the fifth day two shillings. Naturally, the attendance on the first day is very limited. For example, on the first day at this year's Royal only 3,600 people purchased tickets, while on the third day over 63,000 paid admission.

I was impressed with the general excellence, not only of the live stock, for which Great Britain is famous, but also by the size and variety of the machinery exhibits. The machinery, implement and engine exhibits at these shows were very much larger and more interesting than I had anticipated. For example, the machinery exhibit at Southampton would compare very favourably with the machinery exhibit at any show in Western Canada. Musical bands are not used at these shows unless the show wishes to pay an extra tax, so consequently I did not see any military or civil bands at any of the live stock shows in Great Britain.

One at once notices the variety of the breeds seen at some of these shows. Many breeds which are totally unknown in this country in some cases come out in large classes. At the same time one is impressed by the absence of some of the most prominent breeds, which shows that breeds are more localized in Britain, small as the area is, than they are in the United

States or Canada. For example, the Royal Counties Show at Southampton, one of the largest shows in England, had no classes for Yorkshire or Large White swine, and The Three Counties Show, which includes Hereford, Worcester and Gloucester, had no exhibit of Guernsey cattle, although they were out in large numbers at Southampton; and of course the shows in the northern parts of England seldom have classes for Gloucester Old Spot pigs or Wessex Saddlebacks which are so popular in the south. Clydesdales were the only heavy draft horses shown at the Scottish shows, and while they are shown at shows in the north of England they do not appear at the shows in the south, where on the other hand the Shire, Suffolk Punch and a few Percherons hold the field.

In cattle at The Three Counties Show Herefords naturally were first in importance, followed by the Shorthorn, Angus, Red Poll, British Friesian, Gloucester, Longhorn, Dairy Shorthorn, Jersey, and Dexter. The Gloucester, the Longhorn and the Dexter are breeds unknown in this country. In sheep there were classes for Shropshire, Hampshire, Oxford, Kerry Hill and Cotswold, but no classes for Leicester, Lincoln, Dorset or Southdown. In swine, at the same show. Gloucester Old Spots held pride of place followed by Wessex Saddlebacks, Large Blacks, Large Whites or Yorkshires, Middle Whites, and Tamworths.

The Royal Agricultural Show

The leading Agricultural Show of Great Britain, and probably the greatest Agricultural Show in the Eastern Hemisphere, is conducted by the Royal Agricultural Society of England. This is purely an agricultural undertaking, and is truly a wonderful display of the very best live stock that can be assembled. Take it on the whole, with its various breeds and the general excellence maintained throughout, it probably excels any show in the world. There are certain breeds, however, which would have to take second place to the classes in several American and Canadian exhibitions, and in two or three breeds it frequently is surpassed by The Highland, the great show of Scotland.

The Royal, which was held this year in the city of Newcastle, was a success in every way. The attendance was greater at The Royal Shows for the last few years, and the exhibits were quite up to standard. Being a purely agricultural show without any noisy and money spending attractions, the attendance is naturally not as great as it would be did the directors favour this method of attracting the pleasure-loving crowds, but it means that the thousands of people who do attend are genuinely interested in some phase of agriculture. The attendance at this year's Royal totalled slightly under 190,000 people. There were twenty breeds of horses shown, twenty of cattle, twenty-two of sheep and ten of pigs, besides large numbers of varieties of poultry and goats.

Among the breeds exhibited which are rarely or never seen in this country, were many breeds of light horses or ponies, and in cattle, such breeds as Lincolnshire Red Shorthorn, Devon, South Devon, Sussex, Welsh, Dun and Belted Galloway, Blue Albion, Park Cattle, Kerry, and Dexter. The breeds of sheep that we are not familiar with were Ryeland, Kerry Hill, Wensleydale, Exmoor Horn, Herdwick, Swaledale, and various mountain breeds.

The American breeds of swine such as Duroc Jersey and Poland China were absent, but their places were taken by Large Black, Gloucester Old Spot, Lincolnshire Curly Coated, Cumberland, Wessex Saddleback, and the Essex pigs. The two latter

breeds evidently come from the same original stock as the Hampshire hog of the United States.

The horse classes were not particularly large but were of excellent quality; the Clydesdale having as large an entry as the Shire, which is not usually the case at The Royal. A pleasing feature was the great interest shown around the judging ring, hundreds of spectators watching the placings, and by their discussions and comments, showing that they were intensely interested in the various breeds of live stock. If this spirit could be inculcated into our exhibition crowds it would be beneficial both for the live stock shows and for the spectators themselves.

In justice to our own shows, however, it must be said that in proportion to population we draw much larger crowds to our exhibitions, but when we do get the crowds there, they devote a very large share of their attention to the midway and the grandstand attractions. Perhaps it would be feasible to have a live stock parade more than once during the exhibition, as is the present practice at our western shows.

The Highland Show

The Highland this year was held in the quaint and historic old city of Inverness, the capital of the Highlands, and the people of the north gave the show a real Highland welcome. The show itself was of course smaller, and the number of breeds of live stock competing were fewer than at the Royal, but the breeds represented contained many of the finest animals of their kind to be found in Great Britain. The representatives of the Scotch Shorthorn, Angus, Clydesdale, Ayrshire breeds, and many others, were among the best to be found in any country, and it was an education in itself to walk around and examine these splendid animals.

The show was held in a picturesque spot beside fairy haunted Tomnahurich close to the city, and the presence of quite a number of gentlemen in the kilts of their various family tartans gave colour and variety to the scene. The various Highland woollen mills had very excellent stands on the grounds, displaying the very finest Scotch tweeds and tartans. The machinery and implement displays were excellent, and the show, while not extremely large, was very successful, and the attendance practically double that recorded when the show was last held in Inverness in 1911.

Lovers of the Shorthorn would have been glad to have seen Mr. Marshall's noted bull, Bridgebank Paymaster. This bull has been champion at The Royal and champion at The Highland for three years in succession, and well deserves the honour, for he is a beautiful roan, showing great scale, smoothness, quality, and Shorthorn character. Aberdeen Angus men would have found much to interest them around the Angus ring, culminating in the contest between Romping Rover and Black Knight of Auchterarder, resulting in the first mentioned winning the championship. This, of course, was a great disappointment to the supporters of Black Knight, which had won the championship at The Royal for three years in succession and had been champion at The Highland in 1921 and 1922.

The shaggy picturesque Highland breed was well represented, and so were the Galloway, Ayrshire and British Friesian breeds. Red Polls of good type were also exhibited, probably for the first time in the North. In looking over the catalogue I was surprised for an instant not to see any section for Clydesdale horses, but soon found that they were shown under the heading of "Draft Stallions" and "Draft Mares,"

which shows that other heavy draft breeds have not been able to obtain a foothold in the land of the Heather. The stallion championship was awarded to the well known Fyvie Sensation, and the reserve going to his son, Benefactor, winner of the championship at The Royal a couple of weeks previously. Both are owned by Andrew M. Montgomery of Netherhall, Castle Douglas.

The championship in mares was won by a filly foaled in 1920, Raysun, owned by the well known breeder John P. Sleigh of St. Johns Wells, Fyvie; this filly also winning the Cawdor Cup.

The sheep sections were filled with some very fine specimens of the Scottish breeds. Particular mention must be made of the picturesque Black Face and of the proud looking Border Leicester. Excellent Cheviots, Oxfords and Suffolks were on show, and Mr. T. A. Buttar was present with some splendid representatives of the Shropshire breed.

The most popular breed of swine in Scotland is the Large White, but Large Blacks are rapidly overtaking them, and Middle Whites are also fairly popular. There were quite a number of Cumberland pigs shown, but the displays of Berkshires and Gloucester Old Spots were small and Tamworths were entirely absent.

The poultry exhibit was, like the one at The Royal, very excellent with Wyandottes, Plymouth Rocks, Orpingtons, and Leghorns the most numerous, but Scotch Greys, Light Sussex, Dorkings and many other varieties were shown.

In addition to being a great live stock show and having many machinery and industrial stands, there were some educational booths on the grounds such as the stands of the North of Scotland Agricultural College, the Veterinary College at Edinburgh, the Government Forestry Exhibit and several others, all of which were interesting and valuable.

British Flocks

I was able to see only a limited number of the flocks of Great Britain, and naturally confined my visits to the breeds from which I wished to make purchases namely, the Shropshire, Oxford Down and Border Leicester; although at the larger shows I was able to see many fine animals of other breeds, including some very good Ryeland and Kerry Hill, two breeds that are at present almost unknown in this country.

The home of the Shropshire is, of course, in the county after which the breed is named, and with Shrewsbury as headquarters, a visitor can inspect the flocks belonging to most of the famous breeders. Mr. Alfred Mansell, Secretary of the Shropshire Society, lives at Shrewsbury, and of course is very familiar with all the flocks, not only in Shropshire but of the breed throughout Britain.

It was very interesting to inspect such flocks as Tanner's, Everall's, Nunnerley's, Bibby's, Mrs. Inge's, Brown's, Minton's, and others. A very fine two-shear Shropshire ram was purchased from Wm. Everall, his sire being a first prize winner at The Royal in 1920. A shearling was also purchased from Mr. Everall, a ram lamb from Mr. Nunnerley and a shearling from Mr. Tanner, this shearling being in the first prize pen at The Royal this year where the competition was very keen. Outside of Shropshire and the surrounding counties the most noted source from which to secure good stock is the famous flock belonging to Mr. Thomas Buttar, of Corston, Cupar-Angus, Scotland. Several good shearling rams were secured from this flock after careful inspection by Mr. A. E. McLaren and myself.

In searching for good Oxfords for Saskatchewan breeders the flocks of

such men as Hobbs, Stilgoe, Penson, Reading, Akerman, Akers & Co., Watt & Sons, and several others in England, and the best known Scottish breeders such as T. & M. Templeton, Robt. Graham, Wm. Malcolm, Jas. Jeffrey, and others. Some choice Oxford ewes were purchased from Sydney Reading and from the veteran breeder Mr. J. R. Akerman, both in Oxfordshire. Rams were purchased from Frederick Penson, who is such a frequent winner at The Royal, and who won the championship there again this year; from Jas. Jeffrey, of Duchrie, Scotland, from T. & M. Templeton, of Sandyknowe, from Robt. Graham, of Kaimflat, and a very good Oxford ram lamb was purchased from Henry Akers & Co., the breeder who did well in the lamb classes at The Royal this year.

Mr. McLaren and myself found that the English and Scottish breeders of Oxfords are breeding for a type that is excellent as a mutton sheep but does not possess the quality of wool which we are so anxious to secure in this country. They believe that a type which has a very black face and black legs is more hardy and robust than the types that are more of the chocolate or brownish grey in colour. However, when they get very black faces they also get black hairs or fibres appearing in the adjoining portions of the fleece, and the presence of such fibre is very objectionable from our standpoint; consequently the selection of Oxfords was more difficult than of Shropshires or Border Leicesters.

Border Leicesters, such as we saw in northern England and southern Scotland, possess better fleeces and produce a better quality of wool than do the Border Leicesters in this country. Many excellent flocks were visited; particular mention, perhaps, should be made of the flocks of Messrs Jeffrey, Kinnaird, Malcolm, Ross, Montgomery, T. & M. Templeton, and the Earl of Balfour. Purchases were chiefly made from the flock of A. M. Montgomery of Castle Douglas, who won first at The Royal with his two-shear ram.

Twenty head of breeding rams and ewes were purchased for Saskatchewan breeders, and I hope that they will make the long journey without mishap and arrive in good condition.

British Herds of Swine

In swine as in sheep the Old Country farmers spread their energy over a great number of breeds. There were twenty-two breeds of sheep at The Royal and ten or twelve breeds of pigs; many of which not being of good bacon type are not at all suitable to this country. The three most popular breeds in Great Britain at the present time are the Large Black, Large White and Middle White. The Large White is the breed which is known as the Yorkshire in Canada, and they have many good herds in Great Britain.

Mr. McLaren and myself were able to purchase Yorkshires for Saskatchewan breeders from some of the best herds in Great Britain. A boar was purchased from the best herd in Scotland, the Dalmeny herd owned by the Earl of Rosebery. A boar and sow were purchased out of the Walton & Worsley herd owned by Sir Gilbert Greenall, the sow being a grand-daughter of their famous boar, Worsley Jay 35th, which was four times champion at The Royal. Two boars were purchased from the Hallastone & Holsby herd, one of which was already a prize winner and out of a sow that had been a noted prize winner. Two more boars were purchased from the Spalding herd, one of the most famous herds in Great Britain, owned by Mr. Alfred White in Linconshire.

One of the most successful breeders of Large Whites is Mr. Thomas Wherry of Bourne. Two boars and two sows were purchased from his

herd, and a litter brother of one of the sows won 1st prize in a strong class at The Royal about two weeks after my visit and purchase. Two sisters of the other sow, but out of an older litter, were respectively first and third at The Royal. Three very good boars were secured from the herd of the Crighton Royal Institute at Dumfries, Scotland, and in all a total of 14 Large Whites were purchased for Saskatchewan.

One naturally expected to find a considerable number of good Tamworths in England, for the Tamworth is one of the oldest and purest of British breeds, and is regarded with high favour by the bacon trade. Needless to say, I was very much surprised to find that this historic breed has apparently fallen upon evil days, for the good herds of Tamworths are exceedingly few. The majority of them are in Warwickshire, the most outstanding herd outside that county being the Tamworths belonging to Major Morrison, of Basildon Park, near Reading.

The most famous present day breeder of Tamworths is Mr. Robert Ibbotson, of Knowle, near Birmingham, and an outstanding boar was purchased from this breeder, being sired by The Royal champion, and his dam winning the female championship at The Royal this year. With the exception of two or three herds, the Tamworths seen in England were disappointing, and they appear to be decreasing in numbers and popularity. Possibly their real merit will some day bring them back into greater favour again.

There are many fine Berkshire herds in England but only one or two good herds in Scotland. The English Berkshires, while they are good animals, possessing good quality, smooth shoulders, and easy fattening qualities, do not possess the length of side which we are endeavouring to secure in our Berkshires in Canada; consequently although quite a number of herds were inspected, purchases were made only from the noted herd belonging to the Duke of Westminster. These animals carry some of the best blood in his herd, being second generation from his famous stock boar, War Loan, and one of them being out of his good sow, Eaton Warrioress.

A large percentage of British pigs are killed for fresh pork trade; consequently the breeders do not attempt to cater to the bacon type. This fact accounts for the popularity of many breeds that are certainly not of a type to produce the very best bacon. Space does not permit mention being made of the cattle or horse establishments visited while in the Old Country, nor of a very interesting visit to Denmark.

It may be safely stated, however, that Britain richly deserves its reputation as a breeding centre for the majority of the breeds of domestic animals, which have proved their worth on both continents; and while a large number of mediocre animals naturally are produced, her most expert breeders are producing types and strains that will probably keep them in the forefront indefinitely and maintain their present high reputation.

THE AGRICULTURAL SOCIETIES OF ONTARIO

By J. LOCKIE WILSON, Superintendent

THE honour of holding the first Agricultural Fair in Canada falls to Windsor, N.S., in 1765, 158 years ago, and soon other Agricultural Societies fell into line in Nova Scotia, including one at Halifax in 1789 and another in King's County. This latter is the only one of the old Societies in the Maritime Provinces that has survived the present day. The prizes offered at Windsor were in goods and medals. To the persons bringing the greatest number of cattle were awarded three yards of English blue superfine broadcloth and a silver medal. For horses, a saddle, bridle, whip, spurs and a medal were the rewards, and a churn for the best cow, while for the best twelve pounds of butter or cheese the prize was six yards of ribbon and a medal.

The progress of organizing Agricultural Societies in a newly settled country was naturally slow at first; but it is worthy of mention that the first Province to introduce imported stock was New Brunswick, which brought over, in 1826, four Shorthorn bulls, which were recorded in the first volume of the English Herd Book. A provincial exhibition was held in Fredericton, N.B., in October, 1852. An Agricultural Society was organized in Montreal in 1788 and another in Quebec in 1789.

Settlement in Ontario commenced in 1783, and in 1791 had progressed sufficiently along the Niagara river and peninsula to justify the formation of an Agricultural Society on October 28 of that year. This pioneer Ontario society had its headquarters at Niagara-on-the-Lake, then known as Newark. Governor Simcoe took a great interest in it and was its first president. The first efforts of its members were directed to the holding of monthly meetings to discuss agricultural questions, and an agricultural library was also established. The holding of an exhibition naturally followed.

Agricultural Societies gradually became organized all over Ontario, as settlement in the province progressed. In 1830, the Legislature passed regulations governing same and set apart grants. Eight hundred dollars was apportioned to each District Society to enable it to hold an exhibition in addition to the work it had previously undertaken.

An Agricultural Society for the County of York was organized in 1830. Seeds and implements were procured from the Old Country for members. A progressive member was sent to New York State who purchased four bulls for the use of the Society. Soon after an exhibition was held, and prizes were awarded for essays on agricultural subjects.

In 1845 a Provincial Association was formed, and in 1846 the first Provincial Fair was held in Toronto, out of which have grown the world-wide-known Canadian National Exhibition, the Western Fair and the Central Canada Exhibition.

The Provincial Association gradually became better organized and developed into the Agriculture and Arts Association, which did so much for the improvement of agriculture in the province in the earlier days. Among the many useful lines of work inaugurated were the establishment of the Veterinary College, the registering of pure bred stock, the awarding of prizes for the best kept farms and buildings and well cultivated fields, and, indirectly, the Agricultural College at Guelph.

Agriculture soon became such an important feature in Ontario that a Commissioner of Agriculture was ap-

pointed; and eventually the Provincial Government created a Department of Agriculture, thus recognizing this basic industry as of equal importance with those which came under the supervision of the other departments of the Government. Thus out of that little society organized in 1791 in old Niagara-on-the-Lake, with a score or less of competitors and a modest prize list of a few pounds, have developed not only the three great exhibitions at Toronto, London and Ottawa, and hundreds of fairs and exhibitions in the province, but also the important Department of Agriculture with its numerous branches and with local representatives in every county and district, bringing information and assistance to farmers desirous of making use of it.

With the increase in the number of pure bred horses, cattle, sheep, and swine in the province, breeders vied with one another in exhibiting their stock at fairs and exhibitions, and gradually Agricultural Societies discontinued some of their lines of work, important though they were, and concentrated their efforts on fall fairs. Some of these features, which are still recognized in *The Agricultural Societies Act* as part of their work, have since been taken up by other organizations. For instance, the Ontario Ploughmen's Association has held ploughing matches in all sections of the province. These in the earlier days were conducted by Agricultural Societies. An old report refers to two ploughing matches held under the auspices of the York Agricultural Society in 1830, at which the prizes were £3, £2, and £1, and mentions that at one of these matches the first prize went to a Scotchman.

The three hundred and sixty Agricultural Societies in the Province of Ontario have made rapid progress of late years. In 1907 a new departure was inaugurated and a grant was made by the Ontario Government for the holding of Standing Field Crop Competitions, each society selecting the desired kind of grain or other crop grown for seed. Ten societies took part in that first competition and the initial grant was $1,000. In 1922, two hundred and eighty-five competitions were held and the grant was $28,500. For this competition, 152 judges were required to score the fields. In 1920 the Combined Field Crop and Threshed Grain Competitions were inaugurated and 1,000 farmers took part. The grain is first scored in the field, and, after being threshed, is examined in the bins. The prizes are awarded on a basis of 60 per cent on the field score and 40 per cent on the bin score. Only pedigreed seed is allowed to compete, and every competitor has to sow the same variety of grain. In the regular competitions two points are deducted from those sowing non-standard varieties. These Field Crop Competitions have resulted in additional interest being taken by farmers in the cultivation of their fields, with a consequent increase of production, and the additional care taken in cleaning the grain for seed has put them in a position to be able to meet the wide-spread demand for it, which has resulted in great financial benefit to the farmers concerned.

Those visiting the Canadian National Exhibition from year to year have noted the wonderful advancement made in the production of pure seed grain, for which Ontario is becoming noted through these Field Crop Competitions. Never was such a fine exhibit of field crop products shown at any fair on this continent as the one in the Government Building at that exhibition in 1923.

With the exception of ten societies, which devote their energies wholly to the keeping and maintenance of pure bred male animals for which

they receive certain grants, all the societies hold fall fairs and exhibitions. Spring stock and seed shows are also conducted with great success. In spite of the lessened attention paid to horse breeding by farmers on account of the advent of the automobile, the fairs of 1922 were the most successful held, the exhibits of both light and heavy horses being above the average, and other stock in the same degree. A feature that shows great improvement is the poultry exhibit, which is making forward strides each year. The Agricultural Societies of Ontario are certainly manifesting wonderful vitality and their excellent work meets with the approval of all concerned.

AGRICULTURAL REPRESENTATIVE WORK IN NEW BRUNSWICK

By J. E. McINTYRE, B. S. A., Bathurst, N. B.

THE Province of New Brunswick has had five years' experience with the agricultural representative system, and the question may well be asked, What of the results?

Agricultural progress in New Brunswick is not measured by an increase in the number of farms or of farmers, but by a higher standard of living, by material improvement among its farmers, and by the different attitude which now exists towards farming as an occupation.

The extent to which approved agricultural practices have been adopted in those counties where Agricultural Representatives have been maintained is a criterion of the influence this system has had in effecting the general progress, in so far as this can be attributed to the development of agriculture.

The agricultural representative is the promotion agent of government aid to Agriculture, and the "middleman" between the agricultural college and the farmer. He works through personal contact; hence he must discover the needs of those whom he can help before the manner of assistance can be determined. The first widespread attempt at organized marketing of an agricultural product in this province, the co-operative marketing of wool, was effectively promoted through his agency by a farm to farm canvass.

The status of the dairy industry at the time the county agricultural representative system was introduced, was another problem in the solution of which as a promotion agent the representative was signally useful. Too many small dairy factories existed in some parts of the province. Centralized co-operative creameries were an economic necessity. Co-operative effort to a greater extent than had existed among dairymen was necessary. In bringing the facts of the advantages of patronizing the centralized creamery to the patron the usefulness of the agricultural representative was again demonstrated. Inside of three years the organization for three centralized co-operative creameries was completed, cream routes were arranged, and the plants were successfully operating.

The scope for improvement in farm poultry afforded the Agricultural Representative a foothold for demonstrational and educational work among boys and girls. The distribution of hatching eggs, the holding of culling demonstrations, and the giving of instruction in the selection of

exhibition birds for school fairs, brought him into personal relationship where his counsel was appreciated. Through membership in these clubs, many enterprising and industrious boys and girls have become the owners of remunerative farm flocks which give them a keen interest in farm life.

Farm crops is a subject upon which the Representative's opinion is frequently consulted. As an instance: The farmers in one county desired to grow fibre-flax, and communicated with the local Representative, who took the question to the flax specialist. Valuable assistance was thus secured to the growers which made possible the growing of an extended acreage of this crop.

An acre-profit competition for boys in the growing of potatoes was conducted in Carleton County, the centre of the commercial potato growing section, with effective results. Improvement work with this crop—comprising the dissemination of improved seed, encouragement in the use of home mixed fertilizers, the application of sprays, aid in rogueing, and demonstrations of the best cultural practices—is a line of effort wherein the Agricultural Representative is actively participating. He has also been active in promoting interest in County Standing Field Crop Competitions, and County Seed Fairs.

The classes of instruction for farm boys, at winter short courses, in problems of special interest to the farmers of certain sections, have disclosed the permanent influence exerted by this kind of educational work. A midsummer judging competition, held at the Dominion Experimental Farm, Nappan, between teams chosen from the students of different centres where short courses were conducted, served to maintain interest in the study topic from one season to another.

All phases of the extension work carried on by the Provincial and Federal Departments of Agriculture are aided and assisted by the Agricultural Representative. The improved sires policy, the egg-laying contests, pulverized limestone applications, crop insect control, and the development of better markets for farm products are furthered at every opportunity among a population comprising both French and English-speaking farmers. The aim of the Representative has been to meet the farmer on his own farm and to extend practical aid.

The movement is well launched, and has proved of signal effectiveness. It has brought to the farmer the realization that government aid is for him, personally, and it has shown itself to be a useful agency in coping with problems of agricultural education, production and marketing.

DAIRYING IN BRITISH COLUMBIA

By HENRY RIVE, Dairy Commissioner

DAIRYING in British Columbia is a relatively small industry if comparisons are made with other provinces of the Dominion. Until well within the last decade, few dairy cattle were to be found outside the Lower Mainland, including those portions of the province comprised in and adjacent to the Fraser River Valley. To-day the industry is well established on Vancouver Island, the Gulf Islands, and in the Okanagan Valley, while the more remote and hitherto sparsely settled districts of Central British Columbia, the Cariboo and the Columbia Valley have in recent years made good beginnings.

The comparative inaccessibility of these agricultural areas, with the difficulties encountered by settlers in

securing dairy cattle, operated for many years against the spread of the industry and rendered what surplus existed of dairy heifers in the older sections non-available for the newcomer in the newer parts. Several setbacks occurred, also, in the form of land booms, with consequent subdivision and speculation, together with undue attention to specialized fruit growing, to the great detriment of all live stock industries and of agriculture in general.

It is now recognized that with a few much localized exceptions dairying and mixed farming must form the basis of successful agriculture in British Columbia.

In several portions of the province corn yields well for ensilage, while enormous crops of roots can be secured in other parts. Alfalfa does well in the irrigated districts, and everywhere green mixtures such as pea-oat-vetch, etc., and red clover give excellent returns.

Of pure bred dairy cattle the four chief breeds are to be found, the Holstein and Jersey preponderating, Guernsey and Ayrshire in smaller numbers. Grade milking Shorthorns with good production are frequent, but there are no milking shorthorns of pure blood. Dairy Red Polls are represented by a couple of herds, but they are not popular nor likely to increase in number.

Notable records have been obtained by Holstein cattle in this province: Colony Grebegga Valdessa 62388 (641,256 A.H.H.B.), bred and owned by the Colony Farm, Essondale, B.C., world's champion in two year old class with production of 28,538 pounds milk and 889 pounds fat, or 1,111·25 pounds butter.

Agassiz Segis May Echo 41302, owned by the Dominion Experimental Farm, Agassiz, B.C., held until recently the world's championship, having produced 30,886 pounds milk, 1,345 pounds fat, and 1,681·25 pounds butter.

A large proportion of best yielders amongst Jerseys in the Canadian Record of Performance have their home in British Columbia, while high performance in local representatives of both Ayrshire and Guernsey breeds is present. The prospects for worthy dairy cattle within the province are, therefore, good if due attention is paid to breeding and weeding.

Cow-testing associations and cow-testing centres have been in operation for several years, mainly with grade herds, and good progress has been made. The average of all completed lactation periods recorded during 1922 showed a yield of 7,073 pounds milk and 316 pounds fat.

There are in British Columbia twenty-five creameries, three condenseries, two cheese factories, and several plants devoted solely to the manufacture of ice cream. One half of these institutions are co-operative, owned by the dairy farmers.

The total dairy production for 1915 was valued at $3,034,340; for 1922 at $8,001,135.

Prices for dairy products are uniformly somewhat higher than in the more eastern provinces, owing chiefly, no doubt, to British Columbia being still an importing province.

Several million pounds of butter and considerable cheese come in annually from without. Production, however, is steadily if slowly increasing, and it is estimated that, subject to increase in population, from six to eight years hence this province will be in a position to supply its dairy markets.

Splendid opportunities exist for intending dairy farmers to locate on the newer lands of the province in what are known as settlement areas. Where, by reason of lands remaining undeveloped, the progress of a district is being retarded, a Board has been empowered, under *The Land*

Settlement and Development Act and amending Acts, to include any area of undeveloped agricultural land in what is termed a " settlement area." Only tracts which have been found after careful inspection to be suitable for agricultural purposes are included in such areas. Valuations, which are based on this inspection, vary with location, quality of soil, etc.

The establishment of settlement areas has the general effect of providing land for settlers at reasonable prices. Many private owners are either improving their lands themselves to avoid payment of the penalty tax, or are now selling their holdings at reduced prices to conform to the reasonable values placed on similar adjacent lands by the Board's appraisers. It may therefore be said that the effect of the settlement area policy in the districts where it has been put into force has been to stimulate sales of unimproved lands to actual settlers and to regulate prices.

Settlement areas have been established in Central British Columbia along the Grand Trunk Pacific Railway and the Pacific Great Eastern Railway. Immense development of the dairy industry may, therefore, be looked for in the future, as these rapidly filling tracts are well suited to the growing of forage crops and the rearing of cattle.

DEPARTMENTAL CHANGES IN MANITOBA

UNDER a reorganization of the work of the Department of Agriculture of the Province of Manitoba, several important changes have been effected. In future the activities of the Agricultural Extension Service will be divided between the Department of Agriculture and the Department of Education. The Agricultural College, which is under agricultural jurisdiction, will assume control of extension work proper, while Boys' and Girls' Club work will be transferred to Education. Mr. S. T. Newton, formerly in charge of the Extension Service, has been transferred to the Department of Education, where he will have direction of club work in co-operation with the public school inspectors. Mr. N. C. McKay, formerly Assistant Director of Extension, will become Acting Director with headquarters at the Agricultural College. By this arrangement all duplication of educational activities will be avoided, and the club work, to the success of which the school inspectors have largely contributed, will become a part of the Department of Education.

Another important change is the discontinuance of the Agricultural Representatives. This is purely a measure of economy. Recently there have been only four men in the field, and although they have given excellent satisfaction, it is felt that under present conditions, the service cannot possibly be extended to all districts, and that therefore it can, without serious consequences, be eliminated in the few cases where representatives are still engaged.

PART III

Agricultural Education and Related Activities

AGRICULTURAL INSTRUCTION FOR JUNIORS IN ONTARIO

By R. S. DUNCAN, Director Agricultural Representatives, Ontario Department of Agriculture

Rural School Fairs

IN 1912, rural school fairs were adopted as a general policy of the Department of Agriculture and have grown by leaps and bounds, until in 1922 there were 490 rural school fairs, embracing 4,266 schools, with 111,974 pupils taking part. It is estimated that last year 157,486 pupils and 233,298 adults attended the fairs. In 1909 there were only 174 entries; whereas in 1922 it required 225,370 entry tickets.

Each school fair, comprising on the average nine schools, is managed by a rural school fair association, which is composed of representatives from each school, who are elected by ballot from among the pupils. The teacher conducts the election of directors, scrutineers are appointed to count the ballots, nominations are made by the pupils, and a wonderful interest is created at the start which carries through to the school fair. The directors from each school then meet and elect their own officers, consisting of a president, vice-president, secretary and treasurer, and a board of directors. This general Fair Board, under the supervision or guidance of the Agricultural Representative, has charge of the management of the school fair. The officers usually meet two or three times during the season to discuss the prize list and matters pertaining to the fair. Special duties are assigned each officer and director. The secretary keeps a record of the minutes; the treasurer in some cases opens a bank account, and prize money is paid by cheque, countersigned by the president. The youthful exhibitors are then encouraged to open a savings account in the local bank. Practically all the expenses in connection with school fair work, with the exception of the prize money, are paid by the Ontario Department of Agriculture. The amount required for prizes for each fair varies from $60 to $125, the average being possibly $75. This prize money must be secured locally from the trustee boards, township and county councils and from public-spirited persons.

Home Garden Contests

Closely associated with school fair work is a Home Garden Contest, for boys and girls from 12 to 18 years of age, and preferably for those who have graduated from the school fair. Sufficient seed is given to plant a garden 30 feet by 40 feet on the home farm. A pamphlet outlining the plan of garden and giving cultural instructions and suggestions is given to each contestant. The Agricultural Representatives judge the gardens in July and August, and award prizes for the best kept gardens. At the fairs, when prizes are awarded for exhibits, judges are instructed to take into consideration the quality of fresh and canned vegetables, the quantity of

vegetables canned from the garden and the display and attractiveness of the exhibt. Prizes are also offered for the best display of products from the home garden at the school or local township fall fair. These boys and girls are also encouraged to exhibit in the regular sections of the prize list of the local or county fair, and many have been extremely fortunate in winning honours and prizes.

Club Work

Boys' and Girls' Club Work in the Province of Ontario is only in its infancy, though it has made wonderful strides in some other provinces of the Dominion and in the United States. Where organized it bids fair to rival school fair work in its popularity. Perhaps this is due to the fact that boys and girls love animal pets—something that is alive and responds to kind treatment.

These clubs were designed to create in the boy and girl a deeper interest in live stock, to encourage boys and girls to keep records—a home project—and to teach them better methods of feeding and management. The work in Ontario so far has been limited to the organization of calf clubs, pig clubs, sheep clubs, potato clubs and poultry clubs, and was intended primarily for boys and girls from 12 to 18 years of age.

Course for Junior Farmers

The four to six weeks' Courses in Agriculture during the winter for farmers' sons have been a special feature of Agricultural Representative work since they were first started in 1912. They are held at a different point in the county each year, and thus eventually the boys in every part of the county have a course brought to their very door.

The object of these courses is not to teach the farm boy how to farm—practical work on the farm is the best teacher. Their motto should be "Learn Why, for that teaches How and When." The aim is simply to make a study of the underlying principles of agriculture, to induce the young man to enquire more closely into things, to make him acquainted with new and approved ideas and methods, and to instruct him where to look for information. If these courses do nothing more than teach the young man how to think, they pay and pay well.

A special two weeks' course in domestic science, home nursing or sewing for farm girls is usually held at the same time as the course in agriculture for the boys, and joint sessions are held where the lectures are of interest to both.

From 1912 to 1923 the Agricultural Representatives have held 384 month courses in agriculture with an attendance of 9,410 farm boys. This works out approximately to 32 courses per year, with an average attendance per course of 25 students.

While these four to six weeks' courses in agriculture serve a very useful purpose, it has been felt for some time that a larger number of young people in the rural districts would be greatly benefited by longer courses in agriculture and home economics during the winter months. Accordingly, an experiment was tried out during the season 1921-22 of conducting four three-months' courses in agriculture and home economics in the Counties of Huron, Peel, Middlesex and Wentworth. So successful were these courses, and so favourably were they commented upon by every person who came into contact with them, that the Department held eight such courses during the past season from November 27, 1922, to March 2, 1923. During the two years that the three-months' courses have been conducted, we have had a total attendance of 501 boys and 497 girls, or an average per course of 42 boys

and 41 girls. In addition to the agricultural and home economics subjects, special lectures were given for both sexes in English and mathematics, and of some of the older students, at least, it may be truthfully said that they appreciated these periods as much if not more than any other.

Literary societies, organized by members of the classes, constitute one of the important features. Students are given an excellent opportunity to take part in debates, deliver addresses, give impromptu talks, take part in discussions and conduct meetings in parliamentary style.

Junior Farmers' Improvement Association

The Junior Farmers' Improvement Association is an outgrowth of the courses in agriculture. It was felt that there should be some organization by which the young men might be held together in order that the new ideas received, the new methods learned and the interest and enthusiasm aroused would not fall on barren ground and remain dormant. These associations have a four-fold object, namely, educational, social, research and investigational, and financial.

To date we have 109 Junior Farmers' Improvement Associations with a membership of 3,118. Where organized, they are a positive force in rural life. I know of no organization which has as bright a future and through which the Agricultural Representative can do such effective work.

Live Stock Judging Competitions

Live stock judging competitions for junior farmers, which have been a special feature of the Winter Fairs at Guelph and Ottawa and the exhibitions at Toronto, Ottawa and London for the past few years and at the Royal Winter Fair last year, have created a wonderful interest. The inter-county contests stir up rivalry, and live stock breeders watch the results with more than ordinary interest. These young men get an excellent training in judging live stock, learn to appreciate good pure-bred animals, and hence are not contented unless they can commence building up their herds.

PART IV

Special Contributions, Reports of Agricultural Organizations, Publications and Notes

ACCREDITED HERD REGISTER

THE following is the list, by provinces and breeds, of Canadian herds of cattle which on September 1, 1923, had been fully accredited as to freedom from Bovine Tuberculosis by the Veterinary Director General. Supplementary lists of herds subsequently accredited will be published in future issues.

An account of the Accredited Herd System was published in the February, 1923, number of The Agricultural Gazette, pp. 24-27, "Bovine Tuberculosis in Canada."

PRINCE EDWARD ISLAND

AYRSHIRE

Aitken, William, Lower Montague
Auld, R. Brewer, Freetown
Annear, Geo., Montague
Boswald, Geo. L., French Port
Brown, Bert R., York
Cairns, F. L., Freetown
Cairns, R. L., Freetown
Experimental Farm, Charlottetown
Ferguson, C. T., Marshfield
Miller, W. A., Charlottetown
McLean, C. D. & Sons, Clyde River
MacRae Bros., Brookfield
Reid, Edwin, Rollo Bay
Rodd, T. A., Milton
Younker, W. R., Charlottetown

HOLSTEIN-FRIESIAN

Bovyer & Turner, Charlottetown
Gibson, W. J., Marshfield
Godfrey, Chas. & Geo., North Wiltshire
Jones, J. Walter, Bunbury
McCallum, W. E., Southport
McKay, Alex. R., Charlottetown
Morrow, A. W., North Lake
Stewart, Cecil J., Hampshire

JERSEY

Easter, Edgar, North Wiltshire
Glydon, Frank & Son, Kensington
McKay, Alex. R., Charlottetown

SHORTHORN

Auld, R. Brewer, Freetown

NOVA SCOTIA

AYRSHIRE

Byers, E. R., Old Barns

GUERNSEY

Corson, H. C., South Ingonish

HOLSTEIN-FRIESIAN

Experimental Farm, Nappan

JERSEY

Boulden, C. Eric, Windsor
Cann, C. & H., Chegoggin

SHORTHORN

Archibald, C. A., Truro
Experimental Farm, Kentville
Stewart, E. R., Old Barn
Tory, J. C., Guysboro

NEW BRUNSWICK

AYRSHIRE

Atkinson, H. W., Fredericton
Dom. Exp. Farm, Fredericton
Snowball, R. A., Chatham

HOLSTEIN-FRIESIAN

Dom. Exp. Farm, Fredericton

JERSEY

Manchester, J. H., Apohaqui

SHORTHORN

Snowball, R. A., Chatham
Dom. Exp. Farm, Fredericton

ONTARIO

AYRSHIRE

Ballantyne, John, Atwood
Begg, Melvin, Moose Creek
Benning, Jas., Williamstown
Brown, Chas., Burford
Bruce, Dr. H. A., Eglinton
Cairns, Peter, Brantford
Cambell, J. McNab, Dalkeith
Collver Bros., Wellandport
Connolly, W. J., Strathroy
Cotton, Jas., Navan
Cowan, Jos., Silverdale
Cughan, Abel, Athens
Cumming, Donald, Lancaster
Cummings, Malcolm, Lancaster
Dalrymple, A. J., Bismark
Dalrymple, J. A., Bismark
Deeks, Thos. L., Williamsburg
Ducks, W. P. & F. E., Grassie
Dyment, Humphrey, Lancaster
Dyment, N. & Sons, Brantford
Experimental Farm, Kapuskasing
Fairbairn, T. L., Billings Bridge
Fargo, Wm., Charlston
Fraser, T. S., Lancaster
Goodin, Thos. & Son, Spencerville
Grant, Angus, Moose Creek
Gullet, F. W. & Son, Welland
Hamill, H. C., Markham
Harper, A. T., Caledonia
Harris, John C., Mount Elgin
Henderson, A., Athens
House of Refuge, L'Orignal
Howes, F. A., Harold
Howey, C. M., Burford
Kilts, Geo. C., Perry Station
Leeming, Wellesley, Glanford Station
McDonough, J. T., Westover
McDonough, Miller, Westover
McFadden, Wm., Navan
McGregor, P. A., Russell
McNaughton, W. G., Martindown
MacPherson, Wilson & Son, St. Anne
Macoun, Chas., Campbellford
Montgomery, W. L., Gravel Hill
Osmond, C. S., Milton
Palmer, E., Burpee, Norwich
Palmer E. Burpee & Son, Norwich
Pearson, Geo. & Sons, Waterdown
Raison, Geo. H., Harlem
Raison, Levi, Soperton
Rennick, Geo. M., Vankleek Hill
Roy, Dan., Bainsville
Ryan, S. A., Riceville
Schweitzer, Amasa & Son, Bloomingdale
Schwoob, J. W., Welland Port
Shaver, Morley, Millgrove
Sorley, Jas. & Son, Ottawa
Stokes, G. H., Tweed
Tietz, E. F., Hagersville
Tummon, W. E., Cookston
Wood, H. M., Crookston

GUERNSEY

McSloy, J. A., St. Catharines

HOLSTEIN-FRIESIAN

Allied Stock Farm, Wilsonville
Amy, Wm., Burford
Arbogast, Michael A., Sebringville
Arbogast, Peter S., Mitchell
Armstrong, John, Navan
Armstrong, John T., Hagersville
Bales, O. D., Lansing
Barnard, Geo. W., Norwich
Berry, John, Middleport
Bethune, Geo. H., Ryckman's Corners
Boake, H. F., Downsview
Bowman, R. J. & Sons, Hagersville
Bowyer, B. A., Simcoe
Brethen, G. A., Norwood
Brethour & Nephew, Burford
Burt, William, Philipsville
Carlisle, G. F., Newton Brook
Challand, L. W., Port Dover
Christie, Thos., Renton
Clark, A. Harold, Mountain
Clark, H. A., Brockville
Cohoe, Wm. J., Burgessville
Collver, Clayton S., Simcoe
Cornwell, A. E., Norwich
Cooper, Geo., Willowdale
Cowan, Jos., Silverdale
Crang, Jethro, Weston
Culp, S. A., Vineland
Culver, H. Y., Simcoe
Dean, H. H., Guelph
Deeks, J. D., Morrisburg
Dunseith, F. C., Stratford
Eaton Hall Farm, Eversley
Erwin, John, Waterford
Fallis, J. A., Jarvis
Fallis, W. J., Jarvis
Farrow, Frank, Waterford
Flatt, R., Hamilton
Goodfellow, Geo. H., Lancaster
Grier, T. B., Lansdowne
Grier, W. W., Lansdowne
Griffin, F. J., Burgessville
Hamilton Health Assn., Hamilton
Hambly, W. E., Waterford
Hanmer, Clinton E., Norwich
Henning, John, Nanticoke
Hicks, R. F., Newtonbrook
Honey, J. S., Milliken
Hopkins Bros., Ottawa
Huffman, Henry, Hagersville
Hulet, A. E., Norwich
Hunter, Gordon, Niagara-on-the-Lake
Jackson, Jas., Norwich
Jackson, H. J., Norwich
Jakes, J. C., Merrickville
Jantzi, Christian, Gads Hill
Jeffrey, David, Simcoe
Jeffrey, Wm., Simcoe

Jenkins, Thos., Inglewood
Johnston, W. A., Navan
Kitchen, C. C., Simcoe
Kitchen, John C., Nanticoke
Laning, R. C., Waterford
Lawson, Ray, London
Leach, Jno. B., Verner
Lemon, Wilber, Lynden
Leng, Geo., Hagersville
Lindsay, W. D., Hagersville
Logan, J. S., Hamilton
McComb, G. R., Burgessville
McCullough, F. H. & Son, Navan
McFadden, Geo., Navan
McKay, M. J., Cornwall
McLaren, R., Waterford
McLeod, D. W., Dalkeith
McRae, Geo. A., Bainsville
Mallory, B., Belleville
Mason, Wallace H., Simcoe
Merritt, Robert & Son, Sillsville
Miell, H. J., Hagersville
Monteith, S. J., Stratford
Moore, Gordon, Caledonia
Moyer, Ira, Beamsville
Moynihan, John, Aurora
Munday, Mark M., Bowmanville
Nafziger, Moses, Milverton
Nancekeville, W. W., Ingersoll
Nesbitt, E. W., Woodstock
Newman, Leonard, Merrickville
Oliver, Nelson, St. Mary's
Oliver, Robert S., St. Mary's
Ontario Hospital, Brockville
Ontario Hospital, Hamilton
Osler, E. F., Bronte
Parkinson, H. W., Hagersville
Parsons, John J., Jarvis
Phibbs, Ralph, Jarvis
Phillips, John J., Hagersville
Plant, Elsworth, Burford
Porter Bros., Thornhill
Purtelle, E. B., Bloomfield
Reilly, Jas., Shanley
Reilly, T. Carl, Shanley
Ricker, Frank, Attercliffe Station
Risebrough, R. J., Newton Brook
Robb, John A., Lynden
Ruby, Christian, Tavistock
Schuyler, Wesley, Simcoe
Slack, Arthur C., Delta
Smith, Carl, Jarvis
Snider, P. Stewart, Bainsville
Snowden, L. C., Bowmanville
Stainton, A. T., Hampton
Steckley, Nicholas, Wellesley
Stevens, Arch., Delta
Stevens, J. D., Bowmanville
Stevens, W. C., Delta
Stevens, R. R., Bowmanville
Stock & Son, Wm., Tavistock
Stewart, J. W., Lyn
Stuart, C. S., Waterford
Teasdale, Frank, Concord
Terryberry, Carl, Harley
Thomson, D. T., Cainsville
Tinkess, S. W., Avonmore
Tisdale, I. N., Norwich
Waldie, Alex., Stratford
Walker, G. H., Port Perry
Walker, W. F., Port Perry
Wallace, Jere, Spencerville
Watson, J. S., Woodbridge
Watson, W. E., Pine Grove
Webb, Robert, Seely's Bay
Wells, Durham, Morrisburg
Wettlaufer, L. L., Tavistock
Wilson, J. Frank, Hagersville
Wood, J. A., Merrickville
Youmans, Hayes, Waterford
Young, John, Brantford
Young, Wm., Ancaster

JERSEY

Bagg, Fred. J., Unionville
Bagg, Jas. & Sons, Edgeley
Berkley, P. O., Morrisburg
Brown Bros., Oak Ridge
Bruce, Dr. H. A., Eglinton
Bull, B. H. & Sons, Brampton
Chapman, Frances, Malton
Clark, Wm., Meyersburg
Cockshutt, H., Brantford
Decoe, J. S., Simcoe
Evans, W. Selby, Queensville
Fletcher, Carson (Mrs.), Hamon
Fraser, Jas. A., Prescott
Jackson, Geo., Downsview .
Jarvis, Aemilius, Aurora
Johnson, E. A., L'Orignal
Kellum, B., Waterford
Landon, M., Simcoe
Langs, E. R., Langford Station
MacDonald, W. S., Gananoque
Moore, W. H., Rouge
Moote, Alfred & Son, St. Anne
Moote, Ivan L., St. Anne
Nesbitt, E. W., Woodstock
Papple Bros., Brantford
Snyder, A. U., Waterloo
Wood, Chas. F., Aurora
Yonson, T. E., Simcoe

SHORTHORN

Anderson, G. C., Waterford
Auld, A. Gordon, Guelph
Bingle, A., Grimsby
Brown, John, Jr., Harley
Carter, Geo. W., Ilderton
Clark, Lloyd W., Cayuga
Cockshutt, F. W., Brantford
Crone, Scott, Mt. Albert
Daw, Geo. & Son, Glanford Station
Dunnett, G. & W., Hagersville
Dunnett, W. S., Hagersville
Erwin, W. M., Waterford
Experimental Farm, Kapuskasing
Gibson, D. Z., Caledonia
Harper, W. Q., Hagersville

Harper, A. T., Caledonia
Harper, Robert, Caledonia
Hewitt, Harry A., York
Hewitt, Wm. E., York
Hill, G. H. & Sons, Norwich
Howell, A. E., Fenwick
Jackson, Geo., Downsview
Jackson, S. W., Woodstock
Kelsa, Robert A., Monteith
Knight, Edw., Vanessa
McAllister, Andrew, Glanford
McAllister, Jas. D., Glanford
McDonald, F. & Son, Woodstock
Martindale, Ross, Caledonia
Moore, W. H., Rouge
Nie, Emerson, Nanticoke
Plummer, Henry A., Monteith
Pringle, Jas., St. Marys
Robb, Jno A., Lynden
Scollard, Frank, Ennismore
Scott, Hugh A., Caledonia
Senn, J. F. & Son, Binbrook
Smith, Adam A., Hagersville
Walker, John, Nanticoke
Weld, Wm. C., London
Wood, E. R., Burlington

QUEBEC

ABERDEEN ANGUS

Sanders, M. H., Lennoxville

AYRSHIRE

Anderson, W. E., Howick
Beaudet, J. E., Thetford Mines
Beauregard, D., St. Hyacinthe
Beauregard, J. E., St. Damase
Bergeron, Antonio, Plessisville
Bergeron, Athanase, Ste. Sophie
Bergeron, Calixte, St. Pierre Baptiste
Black, David, Lachute
Black, J. H., Lachute
Bois, Louis J., St. Jean Port Joli
Bourdeau, Harvey, Ste. Clothilde
Boutet, Chas., Victoriaville
Brownlee, R. T., Hemmingford
Bryson, Jas. D., Allans Corners
Bryson, S., Brysonville
Budge, E. C., Beauharnois
Cairncross, J. B., Baie D'Urfe
Carignan, Emile, Gentilly
Caron, Jos. St. Gregoire
Cote, Romuald, L'Ange Gardien
Coulter, J. C., Huntingdon
Dennis, Armand, St. Cuthbert
Descoteaux, J. F., Ste. Monique de Nicolet
Dickson, P., Ormstown
Doig, Alex., Lachute
Doig, Andrew, Lachute
Dryden, Wilton E., Cowansville
Drysdale, Thos. E., Brysonville
Durocher, Ulric, Clairvaux
Dupuis, Wilfrid, St. Paul L'Ermite
Elder, Geo. D., Glenelm
Experimental Farm, Lennoxville
Finlayson, G., Ormstown
Fish & Son, A. E., Ayer's Cliff
Fournier, A. F., Montmagny
Fournier, Eugene G., Montmagny
Fournier, G. F., Montmagny
Hamilton, S. J., St. Eustache
Hastings, H. L., Sweetsburg
Hay, Wm., Lachute
Henderson, H. N., Huntingdon
Holmes, Robert O., Howick
Howden, R. M., St. Louis de Gonzague
Huot, Clodomir, St. Canute
Hyde, Chas. F., Huntingdon
Kay, W. F., Phillipsburg
Kettyle, T. Eddie, Lachute
Labelle, F., St. Jerome
Laurentide Co. Ltd., Talbotville
Laurin, Esaie, Lachute
Lees, Jas., Lachute
Legare, Arthur, Sans Bruit
Leishman & Son, Robert, Lachute
Logan, J. W., Howick
Loiselle, Ovide, St. Marc
Lussier, Arthur, Varennes
McAdam, Q. R., Lachute
McArthur, P. D., Howick
McDougall, Robert A., Ormstown
McKay, G. J., Hemmingford
McMillan, Gilbert, Huntingdon
McOuat, J. R., Ormstown
McOuat, Erskine, Brownsburg
Martin, A. R., Thetford Mines
Mosher, W. J. & Son, Noyan
Nesbit, Jas., Huntingdon
Pesant, Jos., Montebello
Pinard, Octave, Ste. Sophie
Proulx, J. E. F., St. Pierre de Montmagny
Proulx, Leopold, St. Ours
Rennie Bros., Huntingdon
Rivard, Donat, Clairvaux
Roberts, W. M., Ormstown
Rodger, Chas. R., Lachute
Rodger, David, Lachute
Rodger, Wm. J., Lachute
Ross, J. K. L., Montreal
St. Cyr, J. Omer, Nicolet
Smith, John A., Lachute
Smith, S. E., Lachute
Stewart, Norman O., Hemmingford
Sweet, F. A., Hemmingford
Tardif, Jos., St. Valere
Taylor, B. J., Ayer's Cliff
Thompson, Wm., Lachute
Thompson, W. D., Stanstead
Todd, Wm., Lachute
Tully, W. C., Athelstan
Vigneault, Gaspard, Ste. Sophie
Walker, G. M., Lachute
Wallace, Walter, Warden
Wilkins Bros., Farnham

BROWN SWISS

Libby, Ralph H., Stanstead

FRENCH CANADIAN

Bourdon, T. O., Chateauguay
Experimental Farm, Cap Rouge
Experimental Farm, La Ferme
Fleurant, W., Ste. Monique
Fowler, H. W. & O. A., Kingsbury
Grandpre, Domina, St. Liboire
Pitre, J. E., Chateauguay
St. Hyacinthe Dairy School, St. Hyacinthe
Van Bruyssell, Ferd., Beaupre

GUERNSEY

Carter, Arthur C., Knowlton
Fisher, R. Eric, Bolton Centre

HOLSTEIN-FRIESIAN

Alexander, J. J., St. Louis de Gonzague
Auclair, Chas., Marieville
Beauregard, Rodrique, St. Damase
Boa & Sons, Lachute
Boyce, E. C., Athelstan
Brown, D. H., Glenelm
Burrill Bros., Gore
Cairncross, J. B., Baie D'Urfe
Collum & Son, Chas., Ormstown
Coulter, W. T., Huntingdon
Cowan, David, Ormstown
Dobbie, Robert, Calumet
Dunn, R. S., Ormstown
Elder, A. W., Glenelm
Elder, Geo. P., Huntingdon
Elder, P. M., Glenelm
Fletcher, E. G., Richmond
Houle, G. E., Nicolet
Ingham, B. S., Lennoxville
Johnson, F. W., Foster
Kerr, Robert T., Howick
Lamy, Pierre, Nicolet
Leblanc, Romeo, Victoriaville
McAdam, Garrison, St. Canute
McMullen, Wallace, Ormstown
McNaughton, A. W., Huntingdon
McNaughton, M. M., Huntingdon
McRae, John, Howick
Marcoux, Elzear, Lennoxville
Menard, J. R., Ste. Justine de Newton
Parker, L. H., Stanstead
Raymond, D., Vaudreuil
Rutherford, Andrew, Brysonville
Sangster, N., Ormstown
Stark, Peter, Huntingdon
Tannahill, John J., Huntingdon
Thompson, W. D., Stanstead
Todd, Chas. R., Huntingdon
Whelan, T. J., Huntingdon
White, A. A., Huntingdon

JERSEY

Aldrich, Edwin A., Lennoxville
Bishop, F. J., Coaticook
Collyer, Alfred, Foster
Davidson, W. S., North Hatley
Edwards, Chas. O., Hillhurst
Ford, G. E., Cowansville
Frank, R. W., Kingsbury
Gale, F. G., Waterville
Geddes, H. W., Way's Mills
Hamilton, J. J., Massawippi
Harkness, Eliza, Bulwer
Holden, E. de F., Frelighsburg
Huot, Irenee, St. Canute
Ingalls, G. H., Abercorn
Lowry, H. E., Sawyerville
McKay, A., Upper Melbourne
Mayhew, Reg. A., Dixville
Norcross, J. W., Foster
Perry, E. W., Ayer's Cliff
Richmond Jerseys Inc., Richmond
Ruiter, Chas. & Sons, Cowansville
Taber, P. W., East Farnham
Thornton, J. L., Coaticook
Wilson, William, Lachute
Young, C. L., Clarenceville

SHORTHORN

MacLaren, Alex., Buckingham
Maxwell, Edward, Baie D'Urfe
Owens, W. T., Montebello
Ritchie, Jas. & Son, Dewitville
Todd, W. S., Ormstown

MANITOBA

ABERDEEN ANGUS

Boughen, A. J., Dauphin
Delgatty, Geo., Gilbert Plains
Garnett, W. F., Carman
Hume, J. R., Souris
Kerr, W. & Son, Virden
Leader, Harry, Burnside
Manitoba Agr. College, Winnipeg
McCullough, R. M., Portage la Prairie
Patterson, Peter, Rosebank
Robinson, J. B., Belmont
Turner, H. G., Wellwood
Turner, Jas., Caroll
Ward, W. J. & Birss, A. A., Dauphin

AYRSHIRE

Dutton, John R., Gilbert Plains
Experimental Farm, Morden
Manitoba Agr. College, Winnipeg

HEREFORD

Dutton, John R., Gilbert Plains
Manitoba Agr. College, Winnipeg
Robison, H. E., Carman

HOLSTEIN-FRIESIAN

Averill, Alfred, Clan William
Hepburn, W. J. L., Virden
Huard, J. A., Otterburne
Johnston, Alex., Balmoral
Layng, J. H., Brookdale
Manitoba Agr. College, Winnipeg
Morland, J. & M. J., Crystal City
Patterson, Peter, Rosebank
Wieneke, F. H., Stony Mountain

JERSEY

Edward, W. V., Souris

POLLED ANGUS

McLeod, R. A. & A. C., MacDonald

SHORTHORN

Agnew, D. W., Douglas
Allison, Andrew, Roland
Allison, Geo., Burnbank
Berry, J. J., Gilbert Plains
Blair, L. I., Ochre River
Clay, John H., Gilbert Plains
Craig, Geo., Brookdale
Dalgleish, R. J., Grandview
Davidson, Geo. W., Lidstone
Dracas, F. J., Carman
Drought, J. H., Millwood
Experimental Farm, Brandon
Fraser, T. B., Swan River
Frazer Bros., Beulah
Garbutt, John H., Rapid City
Gordon, Geo., Oak Lake
Gorrell Bros., Pilot Mound
Graham, P. E., Pomeroy
Gray, Geo. & Son, Graysville
Grayston, Wm., Newdale
Jamieson, Edwin, McAuley
Langill, David, Giroux
Killoh, John, Hamiota
Manitoba Agr. College, Winnipeg
McDonald, J., Purvis
McGregor, D., Carman
Matheson, J. P., Kenville
Menzies, Alex., Shoal Lake
Murray, W. S., Carman
Naisbit, B., Rapid City
Orr, Angus, Carman
Oxby, F. W., Somerset
Price, A. W., Gilbert Plains
Rankin, G. & Son, Oakner
Robertson, R. T., Snowflake
Sanders, Jno., Snowflake
Sanders, W. J., Killarney
Stewart, D., Gilbert Plains
Strachan, John, Pope
Tolton, H. R., Oak Lake
Tulloch, Jas., Graysville
Turner, E. R., Gilbert Plains
Underhill, Geo. H., Moline
White, W. C., Darlingford
Wilkin, L. C., Kane

SASKATCHEWAN

ABERDEEN ANGUS

Bayne, Ansley G., Tuxford
Lee, F. M. & Sons, Marchwell
Lyon, W. D., Deveron
McLaren, W. R., Shellbrook
Richardson, E. P. (Estate), Grenfell
Sim, John, Grenfell
Teece, H., Lemberg
University of Saskatchewan, Saskatoon

AYRSHIRE

Lee, F. M. & Sons, Marchwell
Thomas, C. E. & Son, Lloydminster
University of Saskatchewan, Saskatoon

GUERNSEY

Clausing, Mrs. F. F., Leipzig

HEREFORD

Reid, T. F. C., Moosomin
University of Saskatchewan, Saskatoon

HOLSTEIN-FRIESIAN

Acres, F. L., Qu'Appelle
Experimental Farm, Rosthern
Murray, A. H., Rosthern
University of Saskatchewan, Saskatoon

SHORTHORN

Bergsteinson, H., Alameda
Brant, John, Edenwold
Colquhoun, Chas. S., Maple Creek
Cumming, E., Kipling
Experimental Farm, Indian Head
Hume, E. K., Manor
Jopp, V. W., Rocanville
King, T. W., Regina
McLaughlin, W. J. & Sons, Kamsack
Minor, H. J., Earl Grey
Richardson, E. F., Semans
Murray, A. H., Rosthern
Robson, H. C., Balcarres
Rosom, Harry, Davin
Ross & Holyoak, Indian Head
University of Saskatchewan, Saskatoon
Watson, A. J. & Sons, Oxbow
Watson, Hugh C., Oxbow

ALBERTA

ABERDEEN ANGUS

Henderson, Thos. & Son, Lacombe
Vauxhall Stock Farm, Vauxhall

AYRSHIRE

Black, Alex. D., Airdrie
Heartwell, W. L., Sibbald
Ness, Rowland, De Winton

HEREFORD

Hunter, G. E. & W. A., Calgary

HOLSTEIN-FRIESIAN

Gilbert, Wm., Stony Plain
Hays & Co. Ltd., Carstairs
Laycock, J. H., Okotoks
Richardson, W. G., Nanton
Vauxhall Stock Farm, Vauxhall

SHORTHORN

Allonby, G. K., Crossfield
Allyn, Wm. M., Morinville
Atcheson, J. W., Cayley
Beck, Jacob, & Sons, Ponoka
Hutton, G. H., Lacombe
McDonell, Angus, St. Albert
Sharp, W. W., Stettler
Watson, Thos., Stettler

BRITISH COLUMBIA

AYRSHIRE

Murray, John, Chilliwack
Robson, F., Mayne Island
Shannon Bros., Cloverdale
University of British Columbia, Vancouver
Vanderhoop, J. P., Pemberton Meadow

HOLSTEIN-FRIESIAN

Blackburn, Esther M., Ganges
Buckland, C. C., Sullivan
Experimental Farm, Agassiz
Forde, L. O., Francois Lake
Gowen, Hammond, North Bend
Hoffman, L., Aldergrove
Matthew, A. & S., Westholme
Solly, L. F., Westholme
University of British Columbia, Vancouver

JERSEY

Barton, David, Chilliwack
Bevan, H. W., Duncan
Bulloch, H. W., Ganges
Collyer, A. E., Chemainus
Experimental Farm, Sidney
Grimmer Bros., Port Washington
Matthew, A. & S., Westholme
McLennan, R. P., Vancouver
Matson, J. S. H., North Saanich
Menzies, A. H. & Son, Pender Island
Nelson, J. H. H., Barriere
Solly, L. F., Westholme
Tolmie, S. F., Victoria
University of British Columbia, Vancouver
Willett, Wilfred A., Duncan

SHORTHORN

University of British Columbia, Vancouver

THE CANADIAN HORTICULTURAL COUNCIL

A CIRCULAR setting forth the accomplishments, and indicating the nature of the work being carried on by the Canadian Horticultural Council has recently been issued by the Secretary-Treasurer, Mr. L. F. Burrows, Ottawa, from which the following is an excerpt:—

1. The confidence of the various departments of the Dominion Government has been secured and the Council is now recognized as the official mouthpiece of the organized horticulturists both professional and amateur in Canada.

2. A plant registration bureau, having for its object the protection of plant breeders, has been established and is now actively functioning.

3. Numerous questions concerning the sales tax as affecting the horticultural and allied interests have been taken up with the proper officials and satisfactory adjustments secured.

4. Upon the request of the Council the Department of Agriculture has this year undertaken extensive experiments in the dehydration of fruits and vegetables and has commenced a thorough investigation of the breakdown of certain varieties of apples in British Columbia due to which the fruit growers were suffering severe losses.

5. An extensive publicity campaign has been carried on—over two hundred articles covering various horticultural subjects, having been submitted to and accepted by the newspapers and periodicals of Canada.

6. Upon representation by the Council the law concerning the manufacture and sale of soft drinks, particularly those represented as containing fruit juices, is being more vigorously enforced.

7. Certain clauses in the proposed amendments to the Insect and Pest Act unsatisfactory to the nurserymen and florists were, after a conference, satisfactorily adjusted.

8. Dominion Incorporation was secured for two of the associations having representatives upon the Council.

9. The Council has the assurance of the Department of Agriculture that legislation will be prepared looking to the regulation of the sale of insecticides and fungicides.

10. Through the generosity of Mr. J. E. Carter, Guelph, Ontario, the Council has arranged to present annually, a gold medal having an intrinsic value of One Hundred Dollars, known as the " Carter Medal " to the person who, in the opinion of the Council, had done the most for the advancement of Horticulture in Canada during the year preceding the annual meeting.

11. Continuous pressure has been exerted in numerous directions for a removal of the embargo on Canadian apples, maintained by Australia and Japan.

12. Trial plots containing large numbers of varieties of vegetables and flowers have been established at different centres in order that the true variety names may be established and the lists of varieties offered for sale clarified.

The Council is completing arrangements for:—

(1) A national apple day and national apple week.

(2) A national decoration day.

(3) A national arbor day.

(4) Certification of nursery stock.

(5) A vegetable advertising campaign.

(6) A standard score card for horticultural products, for the use of judges at shows and exhibitions throughout Canada.

The Council is now representative of approximately 85,000 people, and consequently the matters brought to its attention are numerous and varied. It is pointed out, however, that the Council was organized and is maintained entirely by horticulturists, to give service to the horticulturists of Canada on any questions that they may see fit to place before it.

VEGETABLE VITAMINS

By L. F. BURROWS, Secretary, Canadian Horticultural Council

COMPARATIVELY recent is the addition of the word "Vitamin" to our vocabulary, and even though the use of the word is now common, its meaning is not yet understood. Physicians have long recognized the value of vegetables in the daily diet and we are now told that this value lies largely in the fact that they contain vitamins, and that vitamins are necessary to life. Some vegetables contain greater quantities and of different kinds than others. Three distinct kinds of vitamins have been made "A", "B" and "C".

Vitamin "A" is a mysterious element in food, without which children cannot grow, but which grown folks also need. Shortage of vitamin "A" leads to disease of the eye, skin, and kidneys; and it may cause bad teeth, diarrhoea, pellagra, and other ailments. As a rule, seeds of all kinds are rather deficient in vitamin "A", although green peas contain appreciable amounts. Leafy plants, on the other hand, are valuable foods in this regard. Spinach and chard are probably the richest of the common leafy foods in this element, lettuce ranks next, with cabbage holding third place.

The roots and tubers vary, sweet potatoes and carrots ranking first, while white or Irish potatoes contain but a small amount, and it is doubtful if beets, rutabagas and parsnips contain appreciable amounts. Tomatoes, however, are very rich in vitamin "A" and Hubbard squash is also a valuable source. Little work has been done on the fruits but there is evidence that apples, bananas and oranges contain small amounts of this vitamin.

Vitamin "B" is guardian of good digestion and proper functioning of the liver and other glands. This vitamin is found in the germ and branny portion of cereals. In the milling of wheat, however, this vitamin is so completely removed that the best grades of flour are entirely lacking. This does not mean that we should condemn the white breads, starchy foods, white rice, etc.; it merely means that we must choose our foods intelligently and eat more vegetables.

Potatoes, sweet and white, contain appreciable amounts of vitamin "B", although the turnip and onion are more valuable in this regard. The beet root contains a fair amount although its leaves appear to be much richer. This vitamin is also found in the tomato, cabbage, spinach, lettuce, parsley, and the lowly dandelion, the tomato being especially valuable.

While many fruits have not been studied, it is probably safe to state that most fruit juices contain appreciable amounts of vitamin "B". It is likewise probably true that nuts are valuable sources of this vitamin, inasmuch as all nuts that have been studied contain appreciable amounts.

Vitamin "C" prevents disease and promotes the general health. Lack of it gives the skin a bad colour and makes the heart weak. It has long been known that lemons, limes, oranges, and fresh fruits are curative in scurvy. It has only been in recent years that we have understood that this curative effect was due to vitamin "C". While oranges have been used for a number of years in the treatment of infantile scurvy, it is only recently that it has become the common practice to supply orange juice to infants as part of the regular feeding practice. More recently it has been discovered that tomato juice is practically equal to the juice of the orange in this regard, and many physicians in the poorer districts of

the large cities are prescribing strained tomato juice in place of orange juice. The juice of canned tomatoes seems to be very satisfactory for this purpose, indicating that the canning process is not particularly destructive as far as vitamin " C " is concerned. Berries are known to have scurvy-curing properties, although little investigational work has been done.

The Swedish turnip or rutabaga is very valuable as a source of vitamin "C" and the same is true of the carrot. Young carrots are apparently more valuable than old carrots and this appears to be true for many vegetables. As a rule, it is probably safe to state that the vitamin content of vegetables is highest at the time that the vegetable is most prized from the standpoint of tenderness and taste. Potatoes, onions and parsnips are also considered valuable antiscorbutic foods. Rhubarb, lettuce and cauliflower must also be included in the list, while lovers of cabbage salad and " slaw " will be glad to know that raw cabbage is one of the best sources of vitamin " C " that we have. Tomatoes have the three kinds of vitamins necessary to human health. Most vegetables have one or two but seldom all three.

It is probably best to eat our fruits and vegetables in the fresh form when it is possible to do so. There is little, however, to be feared from the usual methods of canning and cooking. If we eat a sufficient amount of vegetables and fruits throughout the year, it will not matter if a small percentage of the vitamins are destroyed in the cooking process. As a rule, long continued heating or cooking is considered undesirable, and air should be excluded as far as possible.

It is not necessary that we be vegetarians. We should be reasonable and sensible and not faddists. Every diet, especially that of growing children, should contain milk, butter, eggs, fresh vegetables, and fresh fruits if we expect to obtain the best results.

Various fruit and vegetable canning recipe books have been issued from time to time, but the best that has recently come to my attention is that issued by the Fruit Branch of the Dominion Department of Agriculture. These booklets contain recipes which have been thoroughly tested, are practical and economical. They may be had free upon request.

NEW PLANT ORIGINATIONS PROTECTED

THE Canadian Horticultural Council, with headquarters at Ottawa, is now prepared to record new varieties of plants of Canadian origin. To this end a Plant Registration Bureau has been organized as a subdivision of the Council, which will have charge of the details of the work. This will include the recording of the name and description of the variety, the name of the originator or distributor, and the testing of the variety to determine its suitability for registration. This, it is believed, will tend to safeguard the rights of plant originators and introducers.

Mr. W. T. Macoun, Dominion Horticulturist, is Chairman of the Plant Registration Bureau of the Council and the following are Provincial representatives:—

British Columbia—Prof. F. E. Buck, University of B.C., Vancouver, B.C.

Alberta—W. H. Fairfield, Supt. Dominion Experimental Farm, Lethbridge, Alta.

Saskatchewan—Dr. Patterson, University of Saskatchewan, Saskatoon, Sask.

Manitoba—Prof. F. Brodrick, Agricultural College, Winnipeg, Man.

Ontario—J. H. Moore, Islington, Ont.

Quebec—Prof. T. G. Bunting, Macdonald College, Que.

Prince Edward Island—J. A. Clark, Supt. Dom. Experimental Farm, Charlottetown, P.E.I.

New Brunswick—A. G. Turney, Provincial Horticulturist, Fredericton, N.B.

Nova Scotia—W. S. Blair, Supt. Dom. Experimental Farm, Kentville, N.S.

Yukon—Jas. Farr, Swede Creek, Dawson.

Further information and application forms may be had from any of the above or from the Secretary of the Canadian Horticultural Council, 21 Cliff St., Ottawa.

LIVE STOCK EXPORTS

IN the first six months of 1923, Canada exported to Great Britain, according to Dominion Department of Agriculture, 30,029 cattle against 4,185 in the same period last year, and 5,108,500 pounds of beef against 2,703,600 pounds; 50,460,600 pounds of bacon against 46,127,500 pounds; 1, 428,700 pounds of pork against 155,900 pounds, and 29,500 pounds of mutton against 34,100 pounds. To the United States in the same period, the exports were 23,659 cattle compared with 12,795 last year; 9,208 calves compared with 5,900; 3,707 sheep, compared with 18,075; 2,979,000 pounds of beef, compared with 5,923,400 pounds; 83,200 pounds of bacon, compared with 108,400 pounds; 375,200 pounds of pork, compared with 384,200 pounds, and 60,200 pounds of mutton, compared with 1,198,400 pounds. It will be noticed that exports to Britain considerably increased and that exports to the United States greatly decreased. On the whole Canada's export trade in live stock and live stock products has been better this year than last, the totals for the six months ended June 30 last showing an increase of 35,696 cattle, of 3,305 calves, of 1,219,100 pounds of beef, of 4,473,200 pounds of bacon, and of 1,308,700 pounds of pork. The only decreases were 14,258 sheep and 1,173,100 pounds of mutton, both due to the falling off in exports to the United States.

FLAX EXPERIMENTS

SINCE the acquisition of property in the township of Clinton, Lincoln County, Ontario, the work of the Division of Economic Fibre Production of the Dominion Experimental Farms, has been considerably extended. It had previously been felt that an addition to the mill at Ottawa was required in order to effectively carry on the operations of the Division, and when the scutch mill at Ottawa was destroyed by fire in 1920, the need became imperative. As a consequence, in the spring of 1921, a flax mill at Clinton, Ont., was leased for two years with the option of purchase at the end of that period. A hundred and eighty-five acres of land in the vicinity was rented at the same time. At Ottawa the mill was designed more for deseeding, retting and

scutching the material grown on small experimental plots, but in Clinton township, experiments on a larger scale and demonstrations with new types of machinery likely to prove useful in reducing the cost of production are made possible. The work that has been carried on in this direction during the past two years is fully described in the report of the Chief Officer of the Division covering 1921 and 1922, just published at Ottawa, which will be found to contain much informative matter of value to the flax grower in any part of the country. Not only at Ottawa and Clinton, but at Branch Farms or Stations in Prince Edward Island, New Brunswick, Nova Scotia, Quebec, Northern Ontario, Alberta, and British Columbia, varieties are being tested for yield, for fibre and for seed. So far, the flax grown at the Experimental Station at Nappan, Nova Scotia, has been productive of the highest yields, with Charlottetown, P.E.I., second along with Kapuskasing, followed by British Columbia and Alberta.

THE CANADIAN COLONIZATION ASSOCIATION'S LAND LISTS

THE Canadian Colonization Association has issued a booklet for each of the Prairie Provinces giving a list of land for sale by private owners. In the aggregate the listings total over a million acres and comprise some 12,000 parcels of land. Prospective purchasers will be furnished with an independent report without charge. In many instances the terms of payment are amortized on the 32 year basis, with no payment for two years after the first, and the balance in thirty annual instalments. The interest rate is six per cent. Comparatively few of the farms are equipped, and as a rule the improvements in the way of buildings, etc., are slight, if any. The lands listed are reasonably accessible to the railway.

CANADIAN VETERINARY MEDICAL ASSOCIATION

THE decision was reached by the Canadian delegates in attendance at the annual convention of the American Veterinary Association held in Montreal in August, 1923, to form a Canadian Veterinary Medical Association. A committee, with Dr. F. Torrance of Ottawa as chairman, was appointed to draft a constitution and to take in hand all matters relating to organization. The committee, which comprises one representative from each province, is as follows: Quebec, Dr. F. T. Daubigny; Ontario, Dr. C. D. McGilvray; Nova Scotia, Dr. Geo. Townsend; New Brunswick, Dr. McLean; Prince Edward Island, Dr. J. A. Allen; Manitoba, Dr. J. B. Still; Alberta, Dr. J. C. Hargrave; Saskatchewan, Dr. Barker; British Columbia, Dr. W. H. MacKenzie.

BUTTER SUBSTITUTES EXCLUDED

OLEOMARGARINE may no longer be imported into Canada, nor is its manufacture in this country permissible. This prohibition came into effect on the first of September, but dealers are given until the end of February, 1924, to dispose of their stock, after which the sale will no longer be legal. The restrictions as to oleomargarine existed in Canada for many years previous to the war. They were removed as a war measure, and their restoration was looked upon by Parliament as being in the best interest of the public.

The product known as renovated butter is also excluded by an amendment to the Dairy Produce Act passed at the 1922-23 session, which likewise shuts out filled milk, filled cream, or filled butter. These articles, which bulk large in the produce trade in the United States, contain fats other than the fat of milk. They have never occupied an important place in Canadian trade and their exclusion will not necessitate any marked readjustment of the dairy produce business.

QUARANTINE AND INSPECTION OF FOXES ENTERING PRINCE EDWARD ISLAND

UNDER and by virtue of the authority conferred upon me by the provisions of the Order in Council of November 30, 1909, containing regulations relating to Animals' Quarantine, I do hereby authorize and direct the inspection by veterinary inspectors of all foxes entering the Province of Prince Edward Island.

Consignors and consignees of foxes brought into said Island shall, on or before the arrival of said foxes in said Island, report the number and description of the same to the nearest Customs officer, and shall submit the same for veterinary inspection at Charlottetown.

The Order of June twenty-second, nineteen hundred and fifteen is hereby rescinded.

Dated at Ottawa, this tenth day of September, nineteen hundred and twenty-three.

(Sgd.) J. H. GRISDALE,
Deputy Minister of Agriculture.

INFORMATION ABOUT CANADA

THE Natural Resources Intelligence Service at Ottawa is a Branch of the Department of the Interior of the Dominion Government maintained to supply information regarding the natural resources of Canada.

Its aim is to centralize and act as a clearing house for information gathered from numerous sources, private as well as governmental.

Inquiries from intending settlers, business men, investors and others interested in Canada, addressed to the Superintendent will be promptly and cheerfully answered.

NEWS ITEMS AND NOTES

The total number of fur farms in Canada in 1922 was 1,009 comprising 960 fox farms, 17 raccoon, 13 mink, 3 skunk, 1 marten, 1 fisher, 4 karakul sheep, 5 beaver, and 5 muskrat farms. Compared with 1921, an increase of 185 is shown in the number of fox farms, and of 12 in the number of miscellaneous fur-bearing animal farms.

The total number of all kinds of fur-bearing animals on fur farms in Canada at the end of 1922 was 29,870, and the total value $5,570,988, compared with 23,105 and $5,977,545 in 1921. The decrease in total value is due to the lower values shown for silver foxes. For the whole of Canada the average value of silver foxes in 1922 was $250, while for 1921 the average was $322. The number of silver foxes on the farms at the end of the year 1922 showed an increase over 1921 of 3,479 or 18 per cent.

The value of the pelts sold from fur farms in 1922 was $549,464. The large item in the production was silver fox, which, being more valuable as well as more tractable, is most successfully bred.

Furs, dressed and undressed, to the value of $14,836,350, were exported from Canada in the fiscal year 1922, the British market absorbing $4,266,688 worth and the United States most of the rest. Canadian manufactures of furs and the home consumption are annually increasing with the growth of wealth and population.

At the close of the war Montreal took a position as an international fur market, holding the first Canadian fur auction sales in 1920, when 949,565 pelts, valued at $5,057,114, were disposed of. Auction sales have also been held at Winnipeg and Edmonton. The Canadian fur market is now firmly established and sales are held two and three times a year.

In 1920 the Dominion Bureau of Statistics commenced the annual collection of returns from fur traders. According to this source, the total fur production of Canada in 1920-21 was valued at $10,151,594, and for 1921-22 at $17,438,867.

"The Saskatchewan Rural Education Association continues to hold the premier place as the most successful and efficient organization for promoting and conducting junior community activities. During the year 1922, Rural Education Associations were responsible for over 60 per cent of the school exhibitions actually held and for over 72 per cent of the Boys' and Girls' Clubs in operation."—F. W. Bates, Director of School Agriculture for Saskatchewan.

At the fifteenth annual meeting of The American Association of Instructors and Investigators in Poultry Husbandry, held at the Central Experimental Farm, Ottawa, Mr. F. C. Elford, Dominion Poultry Commissioner, was elected President for the ensuing year.

Last season nearly four hundred poultrymen asked for the assistance of the Extension Poultry Culling Service of the University of Saskatchewan in culling their flocks, with the result that the inspectors handled and judged, both for egg production and for standard breed characteristics, more than twenty-five thousand fowls.

The Second World Poultry Congress and Exhibition will be held in Barcelona, Spain, from May 10 to May 28, 1924.

The Dominion Entomological Branch supplies the following particulars respecting the new plant inspection and fumigation building at Vancouver, B.C., made necessary by recent regulations under the Destructive Insect and Pest Act. The station is of hollow tile construction, covered with cement, and measures fifty by one hundred feet. It contains four fumigation chambers and, in addition, the large inspection and packing rooms are so constructed that they can readily be used for fumigating grain and other products. Three hundred and fifty tons of grain can be treated at one time.

According to the figures compiled by the Dominion Bureau of Statistics, the apple production of the Dominion is given, by provinces, for 1922, as follows:—Nova Scotia 1,981,000 barrels; British Columbia, 1,000,000; Ontario, 809,000; Quebec 112,000 and New Brunswick 25,000. The total production is placed at 3,838,000 as compared with 4,046,000 in 1921.

In the first seven months of the present year, Great Britain imported 3,274,145 hundredweights of butter, of which Canada supplied 254 hundredweights, and 1,599,703 hundredweights of cheese, of which Canada furnished 201,236 hundredweights and New Zealand 1,110,256 hundredweights. Canada was second as the exporter of cheese to the Mother Country but tenth in the supply of butter.

S. A. Bedford, L.L.D., whose retirement from the public service in the Province of Manitoba was announced recently, has been identified with the agriculture of Western Canada for over forty years, having been one of Manitoba's pioneer settlers. For eighteen years (1888-1906) Dr. Bedford was Superintendent of the Dominion Experimental Farm at Brandon, Manitoba. His association with the Experimental Farms Branch of the Dominion Department of Agriculture dates from 1887, in which year he aided Dr. William Saunders in selecting the sites of the Farms at Brandon, Man., Indian Head, Sask., and Agassiz, B.C.

In 1908, he was appointed Professor of Field Husbandry at the Manitoba Agricultural College, and in 1912 became Deputy Minister of Agriculture for the Province. After filling the latter post for over three years, he became Chairman of the provincial Weeds Commission, which position he occupied until his retirement.

Forest fires in the Province of New Brunswick are reported to have caused greater destruction in 1923 than at any time since the noted Miramichi fire in 1825. The area where the most serious damage occurred was in the vicinity of Five Fingers, but the Tobique and Nipisiquit River sections also suffered heavy timber losses. Several districts that had escaped the Spruce Budworm injury were burned over. The commercial loss from this season's fires has been tentatively figured at $12,000,000.

APPOINTMENTS AND STAFF CHANGES

The appointment is announced of Mr. W. A. Wilson, of Regina, Saskatchewan, as Agricultural Produce Marketing Agent in Great Britain, to take effect from September 16, 1923.

In the opinion of the Department of Agriculture the importance of the British market as a trade outlet for Canadian agricultural produce and the present trade situation in regard to Canadian dairy and meat products in particular, require the appointment of a fully qualified officer to represent the Department of Agriculture in Great Britain and to devote his full time to the study of market conditions in that country, and to the encouragement of the development in Great Britain, and to a less extent in Continental countries, of trade in the produce of Canadian farms and dairies. The present appointment is of a temporary nature, although the position will be a permanent one.

Dr. F. C. Craighead has resigned the position of Entomologist in the Forest Insect Division of the Entomological Branch of the Dominion Department of Agriculture to accept an appointment as Chief of the Division of Forest Insects in the Bureau of Entomology at Washington.

Frederick Torrance, B.A., D.V.S., Veterinary Director General for the Dominion of Canada, is retiring from the Civil Service under the provisions of the Calder Act. Dr. Torrance was appointed in December, 1912, to succeed the late Dr. J. G. Rutherford as head of the Health of Animals Branch, on the appointment of the latter to the Board of Railway Commissioners for Canada. Dr. Torrance's retirement dates from December 1, 1923.

A beginning has been made in the organization of a Division of Dairy Research in the Dominion Dairy and Cold Storage Branch by the appointment of Egerton G. Hood, B.S.A., Ph.D., to the position of Chief of the Division. Dr. Hood at present fills the position of lecturer in bacteriology at Macdonald College. He is a graduate of the Ontario Agricultural College and the Massachusetts Agricultural College at Amherst where he specialized in chemistry and bacteriology.

Mr. M. A. MacLeod, Superintendent of Agricultural Societies of the Province of New Brunswick, will assume the duties of principal of the new provincial Agricultural School which has been established at the Dominion Experimental Farm, three miles from Fredericton. Mr. MacLeod will continue to act as superintendent of Agricultural Societies and as editor of *The Maritime Farmer*, a post he has filled for the past eighteen years.

The Manitoba Agricultural College announces the appointment of F. B. Hutt, B.S.A., a graduate of the Ontario Agricultural College, to the position of lecturer in the poultry department.

ASSOCIATIONS AND SOCIETIES

Canadian National Veterinary Association.—This association was formed in September, 1923, with the object of uniting the veterinarians of Canada in the interests of the profession and to promote research. The following are the officers:—

President, Dr. F. Torrance, Ottawa; Vice-president, Dr. F. T. Daubigny, Montreal; Directors, Dr. C G. McGilvray, Guelph; Dr. J. C. Hargrave, Medicine Hat; Dr. J. A. Allen, Charlottetown, P.E.I.; Dr. M. Barker, Regina; Dr. A. T. McLean, Moncton, N.B.; Dr. J. B. Still, Winnipeg; Dr. Geo. Tornsend, New Glasgow, N.S.; Dr. D. W. McKenzie, Vancouver; Treasurer, Dr. G. A. Dauth, Coteau-du-lac, Quebec; Secretary, Dr. J. H. Villeneuve, 200 West Dorchester St., Montreal.

Ontario Silver Fox Breeders' Association.—President, O. B. Koenig; Vice-president, W. H. Ruthven, Alliston; Secretary-Treasurer, F. B. Utley, Toronto.

Saskatchewan Beekeepers' Association.—President, J. Hubbard, Grenfell; Vice-President, T. H. Mack, Lumsden; Secretary-Treasurer, Dr. S. A. Merkeley, Moose Jaw.

NEW PUBLICATIONS

DOMINION DEPARTMENT OF AGRICULTURE

Experimental Farm, Agassiz, B.C., 1922.—Report of the Superintendent, W. H. Hicks, B.S.A., Dominion Experimental Farms.

Experimental Station, Rosthern, Sask., 1922.—Report of the Superintendent, W. A. Munro, B.A., B.S.A. Dominion Experimental Farms.

Experimental Station, Sidney, B.C., 1922.—Report of the Superintendent, F. M. Straight, B.S.A. Dominion Experimental Farms.

Experimental Station, Summerland, B.C., 1922.—Report of the Superintendent, R.H. Helmer. Dominion Experimental Farms.

Experimental Station, Kapuskasing, Ont., 1922.—Report of the Superintendent, Smith Ballantyne.

Division of Forage Plants.—Report for the year 1922. G. P. McRostie, Ph.D., Dominion Agrostologist. Dominion Experimental Farms.

Division of Field Husbandry, 1922.—Report of the Dominion Field Husbandman, E. S. Hopkins, B.S.A., M.S. Dominion Experimental Farms.

Division of Economic Fibre Production, 1921 and 1922.—Report of the Chief Officer, R. J. Hutchinson. Dominion Experimental Farms.

Destructive Insect and Pest Act.—Regulations thereunder. Acts, Orders and Regulations No. 8.

Rabbits.—By George Robertson, Assistant Dominion Poultry Husbandman and W. W. Lee, Poultry Husbandman. Bulletin No. 28—New Series. Poultry Division. Dominion Experimental Farms.

Dairying in New Zealand and Australia.—By J. A. Ruddick, Dairy and Cold Storage Commissioner. Bulletin No.34—New Series.

Fruit and Vegetable Recipes.—By Miss Ethel A. Preston. Circular No. 17. Fruit Branch.

Size and Colour Minimums for Apples.—Fruit Branch Circular No. 16.

ONTARIO

Report of the Minister of Agriculture for the Province of Ontario, 1921-22.

Beekeepers' Association of the Province of Ontario, 1922.—Forty-third Annual Report.

Care of Farm Implements and Tools.—Bulletin 300. Ontario Agricultural College. By Lionel Stevenson, B.S.A., M.S., Director of Extension.

Breeding, Growing and Finishing "The Bacon Hog."—Bulletin No. 299. Ontario Agricultural College. By Wade Toole, B. S.A., M.S., and R. G. Knox, B.S.A. Department of Animal Husbandry.

QUEBEC

Quebec Society for the Protection of Plants, 1922-23.—Fifteenth Annual Report. Supplement to the report of the Minister of Agriculture.

SASKATCHEWAN

Co-operation and Markets.—Ninth Annual Report of the Commissioner for the year ended April 30, 1923.

Agricultural Co-operative Associations of Saskatchewan.—Official Report of Conference, 1923. Co-operation and Markets Branch.

Co-operative Livestock Shipping.—Bulletin No. 74, Co-operation and Markets Branch.

Agricultural Extension.—Thirteenth Annual Report of the Director on the work of the Agricultural Societies of Saskatchewan during the twelve months ended April 30, 1923.

Rainfall Records for Saskatchewan.—Contributed by the Department of Field Husbandry, Agricultural Extension Bulletin No. 18. College of Agriculture, University of Saskatchewan.

Blackleg.—Its Nature, Symptoms and Prevention. Revised by J. G. Robertson, B.S.A., Live Stock Branch. Bulletin No. 72.

Two Diseases of the Horse.—Swamp Fever and Intermittent Fever (Equine Typhoid). Bulletin No. 71. Prepared by J. S. Fulton, D.V.M., 1923. Live Stock Branch.

Gasoline Engine Ignition.—Contributed by the Department of Agricultural Engineering. College of Agriculture, University of Saskatchewan. Agricultural Extension Bulletin No. 19.

Cheese-making on the Farm.—Contributed by the Department of Dairy Husbandry. College of Agriculture, University of Saskatchewan. Agricultural Extension Bulletin No. 17.

BRITISH COLUMBIA

Agricultural Statistics, 1922.—Bulletin No. 94. Statistics Branch, Department of Agriculture.

Feeding for Egg Production.—Bulletin No 93. With records of results obtained with S. C. White Leghorn, White Wyandotte, Barred Plymouth Rock, and S. C. Rhode Island Red Pullets. By E. A. Lloyd, B.S.A., Associate Professor of Poultry Husbandry, and V. S. Asmundson, M.S.A., Assistant Professor of Poultry Husbandry. College of Agriculture Bulletin No. 6.

Bee Culture in British Columbia.—Bulletin No. 92. By W. J. Sheppard, Provincial Apiarist, A. W. Finlay and J. F. Roberts, Assistants.

MISCELLANEOUS

Live Stock and Animal Products Statistics, 1922.—(Prepared in collaboration with the Department of Agriculture, Canada). Internal Trade Branch, Dominion Bureau of Statistics.

Fur Production of Canada, 1921-22.—Issued by the Fur Branch, Dominion Bureau of Statistics, Ottawa.

Preliminary Report on the Fur Farms in Canada, 1922.—Issued by the Fur Branch, Dominion Bureau of Statistics, Ottawa.

Canadian National Record for Foxes.—Volume 1. Containing the pedigrees of foxes inspected and registered 1920, 1921. Edited in the office of the Canadian National Live Stock Records, Ottawa. Published by the Canadian Silver Fox Breeders' Association, 1922.

Manitoba, Canada.—Its Development and Opportunities. By F. H. Kitto, F.R.G.S. Prepared under the direction of the Superintendent, Natural Resources Intelligence Service, Department of the Interior, Ottawa.

THE LIBRARY

LIST OF PRINCIPAL ACCESSIONS TO THE DEPARTMENTAL LIBRARY, INTERNATIONAL INSTITUTE BRANCH, DEPARTMENT OF AGRICULTURE.

The co-operative marketing of farm products, by O. B. Jesness, B.S.A., Montreal, J. B. Lippincott co. 1923. 292 p. il. (Lippincott's farm manuals, ed. by Kary C. Davis).

The American livestock and meat industry, by R. A. Clemen, M.A. New York, Ronald press co., 1923. 872 p. il. Bibl. pp. 811-841.

Supplying Britain's meat, by G. E. Putnam. London, George E. Harrap & co. 1923. 169 p. il.

Co-operative marketing; the golden rule in agriculture, by Herman Steen. Garden City, Doubleday, Page & co. 1923. 366 p. il.

Farm implements and machinery, by J. R. Bond, M.Sc. and Sir John Russell, F.R.S. London, Benn bros., ltd. 1923. 282 p. il.

Economie rurale, par E. Jouzier. Paris, J. B. Bailliére et fils, 1920. 550 p.

Scientific feeding of the domestic animals, by Martin Klimmer, Ph.D., authorized translation by Paul Fischer, B.S.A. Chicago, Alex. Eger, 3d ed. 1923. 242 p. il.

Parasitologie des plantes agricoles, par le Dr. Maurice Neveu-Lemaire. Paris, J. Lamarre et cie, 1913. 720 p. il.

Economics for commercial students, by Albert Crew, 5th ed. London, Jordan & sons, ltd. 1923. 384 p.

Farm meats, by M. D. Helser, B.S.A., M.S. Toronto, Macmillan co. of Canada, 1923. 274 p. il.

Rural education, by Arthur W. Ashby and Phoebe G. Byles. Oxford, Clarendon press, 1923. 227 p.

Farm fertility, by Sydney B. Haskell. New York, Harper & bros. 1923. 243 p. il. (Harper's handbooks, ed. by W. C. O'Kane).

Outline of genetics with special reference to plant material, by Merle C. Coulter. Chicago, University of Chicago press, 1923. 211 p.

Frost und Licht als beeinflussende Krafte bei der Samenkeimung, von Dr. Wilhelm Kinzel. Stuttgart, Eugen Ulmer, 1913-1920. 3 vols.

Le travailleur agricole francais, par Georges Risler. Paris, Payot & cie. 1923. 281 p. (Bibliotheque politique et economique).

Agriculture commercialisee; pour bien produire, il faut bien vendre, par Armand Bouat. Paris, Librairie agricole de la maison rustique, 1922. 349 p. il.

Animal life and intelligence, by C. Lloyd Morgan, F.G.S. London, Edwin Arnold, 1890-1. 512 p.

Practical landscape gardening, by R. B. Cridland. New York, A. T. De La Mare co. 1922. 276 p. il.

Les principales maladies des habitants de la basse-cour et leur traitement, par G. Moussu. Paris, Librairie agricole de la maison rustique, 1922. 253 p. il.

History of the Smithfield Club, 1796 to 1900, by E. J. Powell. London, published by the Smithfield Club, inc. 1902. 168 p. il.

Poultry, by A. W. Richardson. New York, Harper & bros., 1922. 122 p. (Harper's handbooks, ed. by W. C. O'Kane).

Visual perception of the chick, by H. C. Bingham. Baltimore, Md. Williams & Wilkins co. 1922. 104 p.

The production of 300-eggers and better by line breeding, by M. E. Atkinson, Dayton, O. Reliable poultry journal publishing co. 1923. 415 p. il.

Horse-breeding for farmers, by Alfred E. Pease. Toronto, Macmillan, 1894. 135 p.

The principles of stock-breeding, by James Wilson, M.A., B.Sc. London, Vinton & co. 1912. 146 p.

Cinquieme congres des jardins ouvriers, Paris, 1920. Compte-rendu. Paris, Bureaux de la ligue du coin de terre, 1922. 226 p.

Profitable dairying, by C. L. Peck. New York. Orange Judd, 1907. 174 p.

Pig-breeders' annual, 1923. London, National pig breeders' association 1923. 67 p. il.

Range and pasture management, by A. W. Sampson. New York, Wiley, 1923. 421 p. il.

The American fertilizer handbook, 1923. Philadelphia, Ware, 1923. v.p.

Railroad freight transportation, by L. F. Loree. New York, Appleton, 1922. 771 p.

The shepherd's manual, by Henry Stewart. New York, Orange Judd, 1907. 276 p.

The fern lover's companion; guide for the Northeastern States and Canada, by G. H. Tilton, A.M. Boston, Little, Brown & co. 1923. 240 p. il.

Credit power and democracy, by C. H. Douglas. London, Cecil Palmer, 1921. 212 p.

The farmer's problem, by a farmer. London, John Murray, 1923. 47 p.

Hardy border flowers, by H. H. Thomas. Toronto, Cassell & co. ltd. 144 p. il.

Methods of seed analysis, by C. B. Saunders, B.Sc. Cambridge, National institute of agricultural botany, 1923. 15 p.

L'influence de la temperature et de l'eau tombee sur les recoltes de quelques varieties de froment a Svalof et a Ultuna, by Axel Wallen. Stockholm, 1920. 26 p.

The development of adult education in rural areas. London, H. M. Stationery office, 1922. 55 p.

Report of the Departmental Committee on foot-and-mouth disease appointed by the Minister of agriculture and fisheries, 1922. London, H. M. Stationery office, 1922. 78 p. (Cmd. 1784).

Report of the proceedings of the national milk conference, 1922. London, 1922. 222 p.

Hogs, by A. J. Lovejoy. Chicago, Frost, 1919. 212 p. il.

Insect pests and fungous diseases of farm crops, by A. Roebuck, F.E.S. London, Benn bros. ltd. 1923. 55 p. il.

Animal nutrition, by E. T. Halnan, M.A. London, Benn bros. ltd. 1923. 52 p.

Poultry keeping on the farm, by Edward Brown, F.L.S. London, Benn bros. ltd. 1923. 54 p. il.

Exportation of Canadian store cattle to Great Britain; information and recommendations for the Scottish market; full particulars of the classes of cattle to ship; the ports of landing and lairage accommodation thereat; expenses and cost rates, issued by William Bosomworth & sons, Glasgow, Scotland. Glasgow, 1923. 16 p.

Agricultural co-operation; a selected and annotated reading list, compiled by Chastina Gardner. Washington, Government printing office, 1923. 55 p. (U.S.D.A. Miscellaneous circular No. 11).

An economic survey of a rural parish, by J. Pryse Howell. Toronto, Oxford university press, 1923. 31 p. (Oxford university. Institute for research in agricultural economics).

Practical fruit farming, by R. G. Hatton and Walter R. Elgar. London, John Murray, 1922. 87 p. il.

PART V

The International Institute of Agriculture

FOREIGN AGRICULTURAL INTELLIGENCE

All communications in regard to this section should be addressed to T. K. Doherty, International Institute Commissioner, Department of Agriculture, West Block, Ottawa.

SCIENCE AND PRACTICE OF AGRICULTURE

ORIGINAL ARTICLES

THE HIGHER AGRICULTURAL EDUCATION OF THE FUTURE

By E. MARCHAL, Member of The Royal Academy of Science, Belgium, Professor of the State Institute of Agriculture, Gembloux

Nearly every country in the world possesses at the present time a system of Higher Agricultural Education representing in each case the most advanced stage of specialized instruction.

The actual role of this form of education as well as the question of organization are the subjects of much controversy. Consequently unless active measures are taken without delay, it appears that agricultural education in certain countries is faced with a serious crisis. It seems therefore desirable to determine clearly the ends which should be pursued in these higher studies, so that they may be brought into line with the present general requirements of agriculture.

To judge from prevalent opinion, particularly as shown in Belgium, two opposing points of view are expressed in the quarters most closely concerned. Higher agricultural education as at present organized has been accused of being too theoretical so that the student is not kept sufficiently in touch with the realities of practical work. For example, it is stated that "the training provided at the agricultural colleges is much too scientific; it inspires the farmers' sons with too progressive scientific aspirations, and instead of preparing them for rural life tends rather to alienate them from the work on the land."

For those who hold this opinion, the ideal function of the Colleges is to give careful theoretical and practical instruction in the most approved cultural methods to students preferably themselves originating from the classes directly interested in the cultivation of the soil and thus to train practical scientific agriculturists who will in the future, by their example and influence stand out as leaders in agricultural progress.

This desire to attract students from the country districts leads to the following characteristics in the arrangement of the programmes of study:—comparatively easy conditions of entry, limited duration of the course, a constant effort to give a practical bias to all the branches of instruction (including the basic sciences), the predominance of practical work on the farm and in the fields, over laboratory and lecture work.

The contrary theory is represented by those who consider that the function of higher agricultural education is not only to train students who will disseminate the knowledge of the progress already attained, but also, and more especially to prepare pioneers, research workers, and the moulders of future agricultural progress. With that object in view the courses at the agricultural colleges, leaving aside all questions of professional training, should develop still further the scientific side and definitely take their place amongst the recognized higher University studies.

The writer during a long professional career has become convinced that, agricultural education can best serve the special interests of agricultural science and the general interests of society by following the latter course.

The history of the great discoveries, which during the last fifty years have brought about the transformation of the art of cultivating the soil, hitherto in its rudimentary and empirical stage, into a complex and scientific industry, shows at each step the marks of the direct influence of pure science. Similarly the discoveries made by chemists and physiologists in their laboratories towards the end of the last century

have resulted in the establishment of fundamental laws which determine animal and plant production, while purely abstract biological theories are being utilized at the present time, as a basis for experimental work for still further enhancing the productivity of the soil. It is certain that the patient and laborious researches of MENDEL, followed up and developed by a multitude of experimentalists, are the real source of the first definite stages of actual knowledge in the mysterious realm of heredity. Through the mutation theory of DE VRIES and the pure line selection theory of JOHANSSEN, the Mendelian theory of heredity, still further confirmed as it has been by recent cytological research is dominant in the field of genetics, that most fruitful branch of biology, without which animal and plant breeding would be the merest empirism.

Viewed from another standpoint it must also be acknowledged that the purely theoretical work of mycologists and entomologists, by the light that it has thrown on the evolution of parasites in all its most minute details, has led to the establishment of a scientific basis for the methods of control of plant diseases and pests. Lastly, the peculiarly delicate investigations of bacteriologists and biologists have already begun to throw a certain light on soil microbian life and are opening up a prospect of interesting and profitable applications.

Everywhere and always, pure science constitutes the active source from which, although often it may be by long and devious paths, true practical progress is surely derived. The first stages in this development are multiple. The theory itself is almost invariably the work of scientists which is in no way concerned with the utilitarian aspect of the research work on which they are engaged. It is the affair of less original minds, with a more practical bias, to grasp its possible bearing as regards practical application. Then comes the testing of the new theory, and the stage of practical experiment and finally the general diffusion of the newly acquired knowledge amongst those to whom it is of importance.

However this may be, in any attempt to determine the part played by teaching institutions and research in furthering the great work of the scientific reform of agriculture it must be admitted that the aim should be, pre-eminently to secure the necessary liaison between pure theoretical science and practice and to select from among the original abstract theories of laboratory experts, the ideas that lend themselves to practical application, testing and adapting them to the actual requirements of agricultural technique and finally and above all, to arrange for their general diffusion. The creative side of such institutions although entailing much expenditure of time and energy, has been regarded as a general rule, as of relatively minor importance.

The reason for this situation is to be found chiefly in the method of recruiting professors and research workers, as it is too often the case, that less importance is given to high scientific qualifications than to technical skill on the "practical" side, without which, so it is said, any branch of science however far reaching, often remains sterile in the sphere of application.

The result is that too often the duly qualified leaders of agricultural progress, are not, owing to their lack of sufficient scientific training, fit to undertake original research even under favourable conditions. No other result could well be expected, seeing that the nursery where they are trained and whence they are often far too exclusively recruited, *i.e.* the institutions for higher agricultural education, is often marred by the same fundamental defect.

On the contrary, the march of agricultural progress might be made far more rapid and sure, and much of the labour, expense and trouble of testing and trials might be avoided if our agricultural scientists were given a superior equipment of pure science and could go direct to the original sources of the great discoveries for the maintenance of their activities.

Surveying the great problems in the light of their practical knowledge, and directing from the outset the resulting theories towards practical applications, they would cause science to become in the applied sphere, even more highly productive.

In the writer's opinion, the most urgent need of to-day is rather for true scientists, competent to achieve success in original research, rather than for able technicians or merely popular lecturers. The responsibility for training such men lies with higher agricultural education but if the work is to be adequately accomplished, higher agricultural education must develop and improve its methods and organization in at any rate many countries.

If the ideal scheme for training such highly qualified advisers on agricultural science and practice be considered, it will be seen that the course may be divided into two sections: a genereal scientific preparatory training and professional instruction proper. The first, owing to its specially comprehensive nature is the outstanding characteristic of agricultural instruction; briefly, it includes the various branches of mathematical, physico-chemical, mineral and biological sciences.

In each of these fields, it may be considered that the agricultural student should receive a training in no way inferior either in range or standard, to that required for a degree in pure science. In the writer's opinion the

bias in the direction of "practical application" which is so often abused in the methods of scientific teaching preliminary to specialization, constitutes a serious danger, as it tends, under the pretext that they are abstract and devoid of any practical interest, to the sometimes almost complete neglect of entire sections of science, such as might ultimately be found to provide a source of important practical applications. Such a theory tends to encourage imperfectly qualified students with a limited horizon and sphere of interest, who will always be incapable of carrying out original research to advantage.

The University with its great thinkers and vast and precious teaching resources, is undoubtedly the most favourable milieu for the purely scientific training of the agricultural scientists of the future.

It should not be difficult, by means of judicious interchanges in the programmes of the different faculties to establish an ideal form of complete preliminary instruction, leading up to the special agricultural studies.

The agricultural scientist of the future in the next stages of his training course would thus be enabled to build up his purely professional instruction on the solid foundations of the sciences in general. It is at this stage only that the professional faculty or, in other words, the Higher Agricultural Institute enters into the field. Situated in the country and in rural surroundings, where at every point the instruction can be refreshed and invigorated by practical demonstration, the Institute with its experiment farm, its research stations staffed with eminent scientists should prove a focus of applied science in direct and constant touch with the great general intellectual centre provided by the University town from which, consequently, it should not be too far distant.

The organization of the programmes of study and the method followed at this Institute will not be inspired by the essentially abstract conceptions of pure theory, but by the far more tangible and living requirements of science applied to practice.

In order, however, to safeguard, from the point of view of its specialized character, the type of education which is required, various dangers must be avoided. In certain special schools, though classed as of the "higher" rank, there is a tendency to make the professional instruction degenerate into a kind of technical initiation into the practice of such and such a branch of agricultural industry or speculation. Under the guise of exercises in the adaptation of theory to practice, the student is required to carry out processes and manual operations, which could be far better learnt after the completion of his studies during the course of the stage which every student should pass through before starting on his professional career.

The subject of practical application in higher professional instruction should take the form of training the student how to observe, measure and analyze, to complete his knowledge by means of documentation, and to initiate him into experimental method and individual research. Such studies, it may be added, should tend to occupy an increasingly important position in the time table as their teaching value is inestimable. It is pre-eminently in the study of practical applications and tutorial work that the professor will find his chief opportunity for acting as initiator and revealer; it is at the point of contact of theory with fact that he will best be able to show his mastery and acquire that moral ascendancy that will make his pupils respect and honour in his person both science and professional ability. This is also the stage where he can most readily inspire the student with the love for research and the method to be pursued, by arousing his curiosity either in the progress and results of his special work or in other subjects equally capable of serving as a basis for original study. In short, the sphere of practical application will give the professor the means for establishing on more solid bases than those of an examination, a sound appreciation of the value and real knowledge of a student.

For the student himself, the practical exercises will provide the opportunity of obtaining the most solid and lasting form of knowledge, of developing his spirit of initiative and testing his capacities and of gauging personally his degree of attainment. But, as already stated, the object of demonstration work and practical exercises must remain always at a high standard, as the period which the student can devote to his higher studies is too precious to be spent in carrying out work of a purely technical nature.

Another danger to be avoided in the higher agricultural course is in the writer's opinion the tendency towards an exaggerated specialization. Agriculture viewed as a whole, undoubtedly occupies too vast a field to allow any individual to make a complete scientific study of all its branches. The agriculture of temperate and tropical countries respectively, forestry, horticulture, livestock, chemistry, technology and farm engineering, all form special branches of which an intensive study can be made with the object of training special classes of scientific agriculturists.

It is necessary however, to safeguard the general agricultural training which an extreme specialization would jeopardize and to avoid turning out men with an incomplete equipment, who, although well-trained in the minutest details of some particular

branch, remain, owing to their insufficient knowledge of general methods and broad principles, incapable of seeing, understanding and adapting themselves to what takes place outside the narrow limits of their own accustomed sphere of activity.

A high level of preliminary scientific education, a far-reaching general professional training and a moderate degree of specialization, such should, according to the views of the writer, be the qualifications which the agricultural scientist of to-morrow should be expected to supply.

It should be at once admitted that at present such a programme is already, at any rate in its essential lines, being carried out in several countries. Such countries have realized that the day of a relatively easy victory and diffusion of knowledge is ended and that for wresting from nature the secret of new wealth and for realizing the imperious claims of impoverished humanity in this troubled post-war period, for an increase in the productivity of the soil, an ever increasingly urgent appeal must be made to the aid of Science as the only true generating force of progress.

AGRICULTURAL METEOROLOGY AS A FIELD FOR INVESTIGATION

By Sir A. D. HALL, Chief Scientific Adviser, British Ministry of Agriculture

There are few questions which have more continuously occupied the attention of mankind than the attempt to establish some connection between weather and crops. Primitive man in all ages and regions has hoped to control as well as to forecast the weather, his methods and opinions are wrought into the ritual of his religion. Every country possesses its weather lore embodying traditional correlations of weather and vegetation.

Yet despite the universal and secular character of the observation devoted to it by farmers, even though in primitive times the existence of the community might depend upon the prediction and though in more civilized epochs vast sums of money might be made by successful forecasting, little real knowledge has been obtained especially in countries like Western Europe, possessed of variable weather rather than of settled climate. In ancient Egypt the Priesthood gained its power by its ability to foretell the rise of the Nile; what position might not be attained by men who could have predicted the character of the Indian Monsoon? It was not until systematic records of weather began to be kept that material for the study of correlations between weather and crop prediction were obtainable and even then but little could be made out from them. Probably Sir Napier SHAW's paper of 1905 marked the most definite step in this direction. He showed that the average yield of wheat in England could, in 5 seasons out of 6, be predicted with some accuracy from a consideration of the rainfall in the previous autumn. Taking 39·5 bushels per acre as a maximum, deduct 1·25 bushels for every inch of rain that fell in the previous autumn, and a close approximation to the average crop of the year will be obtained for the great majority of seasons. The foundation for the wheat crop is laid in those months and only in some exceptional seasons does some weather factor in the later development of the crop overthrow the edifice which could normally be erected on the foundations laid down in the earliest stages. What value would Sir NAPIER SHAW'S rule not have been to a wheat merchant or speculator in the earlier days when the price of English wheat was determined by the home production and not by the world's crop? Sir NAPIER SHAW'S generalization was a year or two later followed by Mr. R. H. HOOKER'S investigation of the correlations to be found between the weather and crops of the east of England, and the method he employed of correlation has been extended by other investigators, of whom we may mention WALLEN in Sweden, WARREN SMITH in the United States, and JACOB in India.

This, broadly, is the field of agricultural meteorology—ultimately to predict crop yields from the weather prevailing during their growth. Bound up with the problem, is the determination of the effects of this or that weather element in the growth of the crop at various stages, and weather forecasting itself. It is for example, possible to forecast the occurrence of night frosts and to make provision against them by smoke screens, during the critical period when fruit blossom is setting.

The cultivation and manuring of many crops might be varied to advantage, if one could predict the general character of the weather even a month or two ahead.

From the work already done there appears to be three methods of investigation open. The first, which is purely empirical and depends only upon the analysis of the records available of past happenings, is to trace the existence of some periodicity in crop production and in weather. Many attempts have been made to determine cycles in cosmical phenomena and to ascertain their effects upon weather, the best known example being perhaps BRUCKNER'S period of

35 years and the sunspot cycle of 11-12 years. The difficulty is to obtain data of sufficient accuracy and duration to permit of exact mathematical discussion. One of the most interesting of these attempts is that founded upon an examination of the annual rings of growth of the giant Sequoias of California. As is well known, a tree puts on a ring of growth every year which by its colour and structure can be differentiated from the rings formed in previous and succeeding years. In an ordinary way by counting these rings we can determine the age of a tree that has been sawn across and polished so as to yield a clean section. But we can go further, for the breadth of the ring along any radius varies and affords a measure of the growth made in that season and that growth represents a rough summing up of the character of the weather as favourable to vegetation or otherwise. DOUGLASS summarizes the results of the examination of the rings of about 450 sequoia trees of which the great majority are over 1,000 years of age and as many as 79 over 2,000 years. He finds that the correlation of growth with rainfall is greatest when a period of years is taken, the best results being obtained when a three-year period is taken for trees in dry situations and a ten-year period for trees in moist situations. There is a lag in the movement of the rainfall to the soil in which the trees grow and owing to the natural storage of water in the soil it is only the cumulative effect of several seasons that is reflected in the growth of the tree. Sir WILLIAM BEVERIDGE is attacking the same sort of problem from another angle. Records exist of the price of corn on various markets in Western Europe for the last four hundred years. Up to about 1870 when ocean transport began to develop so extensively and wheat began to arrive in Europe from the Americas, these prices represented the local yield of crops, for there was no means of relieving local scarcity by importation on a large scale or of passing off a superfluity to less favoured districts. These prices can be made to afford an index of production with the proviso that there is a certain cumulative effect to be taken into account. An abundant harvest in one year will produce a carry over which will mitigate a scarcity in the succeeding season, or two or three consecutive unfavourable seasons will so exhaust the stores as to result in something approaching a famine. Given such data, what remains is a prolonged mathematical discussion which will eliminate the cumulative effect and reveal the existence of recurring cycles of good and bad harvests.

Indeed, Sir WILLIAM BEVERIDGE'S preliminary discussion seems to indicate the existence of several minor cycles as well as or perhaps resulting in a major cycle for which there is strongest evidence, which has a period of about 15·3 years. Of course the subject is fraught with difficulty, for scarcity is not the result of one factor; it may on one occasion be due to drought, on another to excessive and long continued rainfall, it may again be caused by mistiming of otherwise favourable elements. There may be distinct cycles for the different weather elements, say of drought or of rainfall, and as these cycles are not necessarily of whole year periods their recurrence may be favourable or the reverse according to the season at which they happen. For example a period of drought in the late autumn or winter will be favourable to winter wheat, whereas a similar drought in April-May might injure the winter wheat and practically wipe out the spring wheat crop, which is the main source of supply in Eastern Europe. A heavy autumn rainfall is most adverse to the subsequent yield of winter wheat, whereas the same amount of rain during the growing period might, if followed by good harvest weather build up an abundant yield. It is known that Sir WILLIAM BEVERIDGE is pursuing his investigation of this class of data. Other analogous materials may be found which will repay examination and may lead to the detection of broad weather cycles that will be helpful towards production in the future.

The tracing of cycles deals only with the broad resultant effect of all the elements of weather. Mr. HOOKER'S method attempts to discriminate between them and to trace the effect of each upon the final crop. Moreover, he divides his year into periods of eight weeks, so that his results indicate the effect of an excess or deficiency of the element at particular times of the year upon the size of the crop. His data are the statistical records of crop yields in the east of England for a period of 21 years beginning in 1885 (since extended to 35 years), and these he correlates with the rainfall and temperature records for the same district. He determines the correlation coefficient not only for the year of growth, but also for the preceding year, the weather of which is often found to have a marked connection with the yields in the subsequent year, even if the crop had not then been sown. For example, with the wheat crop wet weather in late spring, and dry weather in the later summer are moderately correlated with a good yield, but dry weather in the autumn and late winter are much more favourable. Cold in late spring is associated with a good yield, but the favourable effect of heat in the previous summer and early autumn is even more marked. It is clear from Mr. HOOKER'S results that the same weather elements are not equally favourable for all crops in the east of England. Most of them benefit by a dry previous winter, but in late spring the weather requirements of wheat and potatoes are reversed, dry hot weather being favourable to potatoes, whereas wet and cold conditions are associated with good

wheat crops. One cannot study Mr. HOOKER'S results without beginning to speculate upon causes. One can see a variety of reasons why a dry, warm autumn should be favourable to the subsequent wheat crop. In the first place it makes for good cultivation, the seed is put in on a good tilth and not plastered into mud. The average date of sowing is earlier, because the farmer can get on with his operations and in England early sowing is favourable to a good yield. Germination is more rapid, bacterial actions producing plant food are favoured, the plant gets established before the winter. Again, a dry winter is favourable in that it induces an extensive root growth, which renders the plant more independent of subsequent drought. In a wet winter with a saturated soil the root development is curtailed, the plant has a smaller volume of soil from which to draw either water or nutriment, and thus becomes more liable to lodge when the heads become heavy. Many such causes may be traced more or less imperfectly, some are first hand—the direct action of the weather upon the growth of the plant, others are secondary in that the weather is favourable or adverse to the incidence of disease or the fostering of weeds. Some are still more remote such as the effect of weather on the farmers' application of labour. A protracted harvest one year may throw many of his operations out of gear in his preparations for not only the next year's wheat but for his other crops.

The correlation method has the advantage of making no hypotheses as to causes, it reveals the frequency with which one set of facts, facts in the nature of results, tend to be associated with another set of facts which may or may not be causative. Obviously the claim of causation is strengthened if from another side evidence can be adduced to explain such a sequence. And this leads us to the third class of investigations that are necessary in agricultural meteorology. We may attempt the intensive study of a given crop in its response to the weather conditions under which it is growing, in order, for example to ascertain the meteorological factors which are significant in its development. We are all in the habit of using the expression "a growing day." What elements constitute the combination which makes for vegetation? Moisture in the soil, humidity, temperature, illumination, are all likely to play their part; can we establish by experiments the optimum conditions and their dependence one upon another? The problem is inevitably complex because the effect of some elements such as temperature is not always positive. Growth may increase with rising temperature up to a point when further increases become unfavourable and the effect is negative. Again, any one of the elements may become a limiting factor; for example water supply and temperature may be sufficient, but growth may be limited by deficient illumination. What are the limiting rates for each of the elements when the others are at their optimum, and which of them are likely to be operative under average conditions? The investigation is not an easy one, even the choice of test plants presents difficulties. If we are measuring vegetative development, we can take as index the increase in length of the shoot, or even weigh the dry matter produced in a given time. But we have also to take into account the age of the plant and the amount of previous development. If a plant has grown well during its first stage it will be the better able to make use of favourable conditions in the second period; in other words weather conditions favourable or unfavourable have a cumulative effect on the final production. Still, these difficulties can be overcome and when working on a small scale, the weather factors may to a certain extent be controlled so as to reduce the experiment to a single variable. We might for example be able to maintain water supply and illumination at an optimum and determine the effect of temperature. Even then the problem presents further difficulties because vegetative growth is only one part of crop production. We can for example by excessive supply of nitrogen compounds enormously increase and prolong the vegetative development of the wheat plant but it does not follow that we can under normal conditions of climate obtain a corresponding increase of grain. The plant may prolong its growth until the season does not permit of much grain formation or of its ripening. In the case of the winter wheat crop we can distinguish three or four distinct periods of development, each demanding its own weather conditions. In the autumn or winter, root development is all important, for which we have seen a comparatively dry soil is favourable. Next follows the vegetative period proper of above-ground growth. Then the plant enters upon the stage of migration, when the material accumulated in leaves and stems is moved therefrom and remade in the grain. This period overlaps the former one, for in an English type of climate, at all events, assimilation of material from the air and from the soil does not cease with the formation of grain, though it gradually runs down to a minimum before the process is complete. In continental climates with high summer temperatures the stage is probably more sharply defined. There is evidence that warmth is favourable to the migration process, on the other hand it may be curtailed by excessive dryness. The migration process merges into the last stage of mere ripening, when from the physiological point of view the weather can affect the yield but little; but when frost, excessive rain or wind may have a serious adverse effect upon the

commercial yield. One of the fields for investigation thus becomes the determination for each crop of the critical periods of its development and the particular weather conditions that are dominant in each period. The work then becomes associated with investigation by the correlation method, because it becomes possible to concentrate attention upon the critical period and to establish a causal instead of a merely empirical connection between the crop production and the weather.

Intensive investigation of the kind under discussion may also lead to the further knowledge that is needed concerning the meteorological data to be obtained in order to be of service in the study of crop production. It is uncertain whether those at present collected by meteorologists are such as have the most bearing upon the development of vegetation. Rainfall has for example two effects, it determines the water content of the soil upon which depends the water supply to the crop, and it influences the humidity of the air, which again effects the development of the plant. Clearly the distribution of the rainfall as well as the absolute amount within given periods is a factor, but it is not obvious how to use the rainfall records so as to translate them into figures bearing directly upon plant growth. It may be desirable to obtain records of the moisture in the soil though it is difficult to establish the unit of measurement in view of the variation induced by the nature of the soil itself and its situation. As regards temperature, the usual data provided are the daily records at 9 a.m., the maxima and minima and less generally the traces given by self-recording instruments. From these with more or less accuracy, the accumulated temperature in hour degrees above a chosen datum line may be calculated, but research is still needed to determine which is the best figure to use as having a causal connection with plant development. Again as regards humidity, we have in the first place to choose between dew point determination and the percentage of possible humidity. When, again, within the day should the humidity be determined or should some integrated figure representing the average humidity of the day be aimed at? Some measure of evaporation may prove to supply a better measure of the effect of the atmosphere upon the plant than humidity determination.

As regards radiation our ignorance is even greater. Sunshine records are generally available and it may be of more service to determine total solar radiation. Beyond a certain intensity sunshine may have a negative effect upon vegetative growth, inasmuch as it induces the closing of the stomata, and the partial suspension of transpiration and respiration.

These are all questions upon which the plant physiologist working intensively upon the individual plant, must reach some conclusion before the investigator applying the method of correlation can know what meteorological data are necessary to him as being causally connected with crop development.

Some further consideration must also be given to the data for crop production, which the investigator of agricultural meteorology has to use.

With few exceptions statistics of crop production are estimates obtained in each country from a corps of observers, more or less trained for their work. Like all estimates the results are subject to certain general errors of which the most important in this connection is probably the tendency to smooth the actual curve of varying yield. Big crops are under-rated, while the yield is often over-estimated in bad years. The effect of this is to obscure the correlations that would otherwise be obtained, at any rate to blunt the sharpness of the conclusions that could be drawn. It has been suggested that much more exact index of production could be obtained if in the country in question some convenient number, say, 50, of farms were selected, suitably scattered over the country, reasonably typical of their district and stable in their management, and the actual yield per acre for the standard crops were measured on these farms. The mean of the yields thus ascertained would give not perhaps the true yield per acre of the country, but an index figure that would vary from year to year with the true yield, a figure which might represent with a degree of accuracy, depending upon the number and choice of the measurements made, the fluctuations in production of that country in response to seasonal fluctuations. An index figure so obtained would be valuable not only to the investigator of meteorology but to statisticians generally. The question is however too general for discussion here.

Enough perhaps has been said to show that the question of data is of prime importance in the still infant science of agricultural meteorology. It is a difficult subject in which for some time to come progress is not likely to be rapid, but for that progress above all investigation is necessary. The meteorologists are still in the main waiting for a lead from those concerned with the agricultural side of the problem and that lead can hardly be forthcoming until further research has been carried out on the reaction of the crops to the various elements of weather.

CROPS AND CULTIVATION

166.—**Arsenate of Sodium in Soil Fertilization.**—RIVIERE, GUSTAVE, and PICHARS, GEORGES. *Annales de la Science Agronomique Francaise et Etrangère*, Year 39, No. 6, pp. 366-370. Paris, 1922.

The author concludes from the results of his experiments that arsenate of sodium in small quantities (two or four gm. per square metre) has no injurious effects upon farm crops, but is sufficiently toxic to kill the protozoa which destroy the useful soil bacteria. Like other similar substances, sodium arsenate exercises indirectly a fertilizing action.

169.—**Value of Lime and Inoculation for Alfalfa and Clover on Acid Soils.**—GRAUL, E. J., and FRED, E. B., *Agricultural Experiment Station of the University of Wisconsin, Research Bulletin* 54, pp. 1-22. Madison, Wisconsin, 1922.

The authors have demonstrated the value of lime and inoculation for alfalfa and clover on acid soils. Field experiments were carried out on two types of soil, representative of a large area of Wisconsin silt loam, left without cropping for thirty years, and similar soil cropped regularly, and sand cropped for many years. The acidity was equivalent respectively to 1·04 gm., 0·86 gm. and 0·21 gm. of calcium carbonate, per 100 gm. of soil. In the earthenware jar tests, the soil was kept at about 50 to 60 per cent saturation with distilled water. The finely ground limestone contained about 60 per cent calcium carbonate and 40 per cent magnesium carbonate. The rate of application of potassium and phosphate was 516 lb. per acre. The effect on the sand was marked, almost negligible on uncultivated silt loam, and slight on cultivated silt loam. In the field experiments this application was omitted.

On the silt loam, inoculation would suffice to greatly increase the yield in the total amount of nitrogen. However, the combined treatment of inoculation and liming still further augmented the increase, *e.g.* in the greenhouse, inoculation alone gave an increase of 15·6 per cent alfalfa (4 cuttings); and liming 40·2 per cent, and the combined treatment 49·7 per cent and an increased nitrogen content to 52·3 per cent. On uncropped soil the increase amounted to 70·3 per cent yield and 79·4 per cent nitrogen (3 cuttings). In the field experiments the results were even more marked—the increase in alfalfa yield was 67·1 per cent after inoculation and 120·4 per cent with combined treatment (liming at the rate of three tons per acre). Still more marked increases were obtained when 8 tons of limestone were added. Nodule bacteria alone increased the nitrogen percentage (87·7 per cent) and adding limestone 160·2 per cent.

On sandy soil, calcium carbonate in addition to inoculation resulted in an increase of 182·8 per cent and gave 319·7 per cent nitrogen (clover).

As a general rule liming has proved more effective on dry land rather than on fertile soil, for example, on poor sandy soil, the nitrogen increase for alfalfa was 87·5 lbs. per acre for each of 5 cuttings, whilst on more fertile silt loam the increase was only 41·3 lb. Small applications of lime are advised; an excess is not only useless but occasionally has a deleterious effect, as is shown by the following typical example. On soil cropped with clover the amount of nitrogen per acre for one cutting was as under:

Clover unlimed.....				100·2 lb.
"	1¼ tons calcium carbonate			140·0
"	2½	"	"	72·8
"	5	"	"	12·5

The amount to be used should be measured according to the proportion necessary for plant requirements. This corresponds to from ¾ tons per acre on silt loam and to 2 tons on sands.

The use of calcium sulphate gave inferior results as regards crop yield, and calcium acetate gave the maximum yield and maximum amount of nitrogen when applied at the rate of one-half the full equivalent of calcium carbonate.

Observations indicate that plants obtain a certain percentage of nitrogen from the soil and the remainder from the air.

Soil Aeration.—ROMELL, L. G., of the Swedish Institute of Experimental Forestry, in *International Review of the Science and Practice of Agriculture*, April-June 1923, pp. 281-297. Reviewed by Dr. P. H. Bryce, Ottawa.

A study by M. Romell of the factors which enter into the problem of soil aeration and the practical effects of aeration on plant growth, is of great scientific interest as supplementary to former studies of a very difficult physical problem.

Roughly speaking plants obtain their nutrition through two sources, the gases of the air, chiefly its carbonic acid, and the soluble salts contained in the water of the soil. The study shows that the presence in the soil of plant foods depends upon the free entrance of the air into the upper 8 or 10 inches of soil for shallow-growing plants and to greater depth for trees and deep-rooted plants generally.

3. The amount of free air spaces in the soil depends on the size of the interstices between the soil particles, varying from a capacity, in sands for holding water before it leaks out

of only 25 per cent, in loams of 50 per cent, and in forest humus and clays of from 65 to 75 per cent of the volume. Romell points out, what has been noted before, that the air near the earth as in the forest and near the plants contains more carbonic acid than normal air; and that its source is the soil. Thus during plant growth Romell estimates the amount of carbon transformed into plant tissue during a week of growth per hectare (about two acres) as amounting to a maximum of 900 kilograms or roughly 2 pounds per week. Or more exactly, Romell found that 7 litres of carbonic acid are given off from a square metre (rather over a yard) in 24 hours over cultivated fields. The amount of this given off from the upper 8 inches of soil would be fourteen times this amount if the gas could not escape either above or below.

4. Of course, if the soil is filled with water there can be no air circulation, but so soon as the water evaporates or sinks deeper the spaces in the soil become filled with air. Now as to what this air consists of will depend on the amount of organic materials as manures in the soil, which become the food for bacteria in the presence of oxygen got from air circulation in the soil, and which is utilized to form carbonic acid and ammonia, which goes to form soluble nitrates available for plant food.

5. Now Romell uses the amount of carbonic acid present in a given cubic metre of soil as an indicator of the circulation of the outer air with its contained oxygen in the soil, and has made a detailed estimate of the most important conditions which enter into the diffusion of the gases and air in the soil.

6. He has grouped the factors under five heads, those of temperature, atmospheric pressure, water, wind and diffusion. Romell has shown that the effect of temperature on the volume of the air in the soil is slight, the variation being only from 1-600 to 1-800 of the normal aeration, since as the ground gets heated so do the air currents near it. It may however, be very considerable in coarse-textured soils, the normal rate of diffusion for an average of soils being from 0·05 to 0·11 square metres per second. But so soon as the area of the soil spaces approaches the size of the free path of the air molecules, the diffusion process is no longer normal, even for very close clays.

7. Naturally air diffusion is slow in damp soils, and ceases when the pores are filled with water. Further, the more the bacterial activity is concentrated in the upper soil, the greater is the diffusion factor. This is chiefly within the upper foot of the soil under ordinary cultivation. This is admirably shown in a diagram shown in the article under review.

8. Thus there is an excessive air diffusion in the upper 6 to 8 inches of soil, and in such depths of soil thorough aeration or ventilation of average soils not too damp or fine grained and the process is continuous. None of the other factors ordinarily plays any such important part as diffusion. Any standard such as a complete air renewal in the upper 6 to 8 inches in an hour may be taken for comparison, and this is most practical since it is in this upper layer that the bacterial activity is most intense, and is largely negligible at greater depths.

9. It is further important to know that it is the size of the interstices or lacunar spaces, which is of the greatest importance rather than in the size of mere surface openings. Hence the agriculturist must take pains to insure the necessary permeability. The higher the activity demanded the greater the porosity required. Thus the breaking up of the soil by cultivation when a liberal supply of manure has been added and the climate is hot, promotes greater soil aeration.

10. If the wind played a great part in this air circulation it would be important that the surface be left in clods and not pulverized. The essential point to insure soil aeration is porosity, and this is generally greatly lacking in a heavy soil. Well-worked garden soil is the type of intense activity due to the nitrifying bacteria of the soil.

11. But this cannot go on in soil of too fine texture, badly aerated. The only condition for aeration of a close heavy soil is drainage of the subsoil. Rain fills the air spaces and also takes up and holds fine soil particles, and greatly hinders aeration. Hence breaking up the surface after a heavy rain is most desirable since the air spaces of the surface are filled and the air movement is prevented. To prevent this it is advised that the surface be covered with straw litter or similar materials and even clods; but best of all, provision should be made for subsoil drainage to draw off the water and prevent the crust forming.

12. Unsatisfactory results often follow planting too closely both in horticulture and agriculture due to insufficient aeration of roots. Too deep planting lessens air diffusion. In Germany, ventilators have been added to the subsoil tile drains to increase aeration, but probably its good effects are mostly due to the increased drainage of soil. In fact the most serious hindrance to good aeration is excess of water in soil; hence the removal of useless water is the surest way of allowing good soil ventilation. Soil too fine as procelain clays make aeration practically impossible.

210.—**Poisonous Metals on Sprayed Fruits and Vegetables.**—Lynch, W. D., Haywood, J. K., Quaintance, A. L., Waite, M. B., *U. S. Department of Agriculture, Bulletin No. 1027*, pp. 66, bibliography. Washington, 1922.

Study undertaken to ascertain the amounts of arsenic, lead and copper remaining on fruits and vegetables treated with poisonous sprays.

Results of previous investigations are given, followed by a description of the experiments made with peaches, cherries, plums, apples, pears, grapes, cranberries, tomatoes, celery and cucumbers. Various methods of analysis were employed.

The following general conclusions may be drawn:

Comparatively large quantities of spray residues were found only when sprayed to excess, or in the case of late sprayings. In one instance 0·13 per cent of lead was found on apples (dried fruit). The poison is liable to accumulate in the calyx. This indicates the importance of strictly adhering to the regulations recommended by the Bureaus of Entomology and Plant Industry. Practically all of the spray residues can be removed by peeling the fruit.

LIVE STOCK AND BREEDING

67.—**Breeding Cattle for Milk and Beef Production.**—I. Will the Farmers' Cow Come Back? *The Breeder's Gazette*, Vol. LXXXII, No. 5, pp. 109-110. Chicago, 1922.

II. Dual Purpose Cattle in England. *The Breeder's Gazette*, Vol. LXXVII, No. 6, pp. 141-142. Chicago, 1922. Among English Dual Purpose Shorthorns. *The Breeder's Gazette*, Vol. LXXXII, No. 7, pp. 175-176. Chicago, 1922.

III. Dual Purpose Cattle in America. *The Breeder's Gazette*, Vol. LXXXII, No. 8, pp. 207-208. Chicago, 1922. The Dual Purpose Idea Has Been Accepted. *The Breeder's Gazette*, Vol. LXXXII, No. 9, pp. 230-231. Chicago, 1922.

IV. Tillsson, E. H., A Brief for the Milk and Beef Shorthorn. *The Breeder's Gazette*, Vol. LXXXII, No. 13, p. 443. Chicago, 1922.

V. Ash, E. C., Can the Red Poll Become the National Breed? The Evolution of the Dual Type. *Live Stock Journal*, Vol. XCVI, No. 2538, p. 514. London, 1922.

VI. Can the Red Poll Become the National Breed? *Live Stock Journal*, Vol. XCVI, No. 2539, p. 539. London, 1922.

VII. Newton, C. F., Dual Purpose Cows' Persistence in Milking. *Live Stock Journal*, Vol. XCVI, No. 2540, p. 571. London, 1922.

X. Miller, W. L., Developing the Dual Purpose Herd. *The Breeder's Gazette*, Vol. LXXXII, No. 5, pp. 110-111. Chicago, 1922.

I.—The author describes the dual purpose cow (bred for beef and milk production) as follows: the animal weighs, when in good condition, 1,100 to 1,500 lbs.; during the lactation period, it yields 500 to 1,000 gall. of milk, and fattens easily when dry, giving a high dressing yield; the meat is marbled and savoury. The dual purpose cow is more resistant to disease than the specialized animal bred for either milk, or beef, production.

Seventy years ago, there were many dual purpose cows in the United States; for the farmers in those days were constrained by circumstances to keep this type of animal which has been perpetuated and improved by natural and artificial selection.

Then agriculture developed, and industrialization and specialization arose. Improved breeds of milk, or beef cattle were imported, and the beef of the dual purpose cow could not compete with the cheaply produced meat sent from the ranches of the far west, while her milk yield fell far below that of the breeds of heavy milkers used to supply the towns.

The exclusive production of either meat or milk does not, however, suit all districts, and many farmers cannot specialize in either butcher's beasts, or dairy cows. The breeding of dual purpose cattle would not be prejudicial to the single purpose breeds. To obtain the first type of animal, it is necessary to breed for several years from parents belonging either to beef, or milk, breeds. Single purpose herds, on the other hand, can sometimes be improved by a dual purpose bull. Further, specialized breeds of cattle fill their own place in the production of animal products, and thus have little to fear from the appearance of a new type, while certain areas are not so well suited for rearing dual purpose cattle, as for breeding dairy, or beef animals.

In districts where much maize is grown, it would be profitable to rear more cattle; in this case, the author is of the opinion that the dual purpose cow is to be recommended.

Milk consumption in the United States will probably increase, and customers will become more particular that the milk shall come from healthy cows. As specialized animals are liable to disease, it will be necessary for dairy farms to become larger. The milk of cows belonging to large herds is more wholesome than the milk from small intensive dairy farms found in the neighbourhood of towns.

The improvement of means of communication and the extension of motor-lorry transport will promote the development of the dairy industry, as butter-factories will be able to buy their cream from little villages in the provinces and thus provide a market for the milk of dual purpose cows.

II.—The author made a tour in Cumberland and Westmoreland (England) in order to obtain information on the subject of breeding dual purpose Shorthorns. These cattle have been continually selected for beef and milk production. They are well-

shaped with straight back, well-developed udder, soft skin, and have usually a roan or white and red coat. The individuals are very true to type, although the author thought the adult cows rather small. On remarking this to a local breeder, the latter explained that size was not required in a dual purpose breed, for the Westmoreland cows give as good milk and as much milk in proportion as larger cows; they inherit beef and milk yielding properties which they transmit to their descendants and are excellent dual purpose stock, whatever may be the weight of the females.

One farmer who was boasting of the good milking capacity of his Shorthorns remarked that all these cows are good beef animals, while another admitted that it was not easy to maintain the equilibrium between milk and beef production, but if the cows yield plenty of milk and fatten easily, their calves will be satisfactory to the breeder and the butcher, while the type can be corrected or maintained, by having the cows served by bulls which will increase the aptitude for either milk, or beef production in the calves.

British breeders of dual purpose cattle replace the cows in their herds as quickly as possible. thus getting rid of worthless cows before they get old, and lessening the number of worn-out animals to be fattened. In this way, the meat remains of good quality. The bulls used on farms where dual purpose cattle are reared are taken either from beef, dairy or dual purpose herds.

These bulls, when adult, are generally very large, long and deep; they have very straight backs and carry their heads high. The best are the offspring of good milch cows. A satisfactory bull must have a dam with a heavy milk yield, and in some herds will have more value, if its paternal grandmother was also a good milker.

The calves are reared on whole milk. Shortly before weaning, and directly after weaning, they are given large quantities of dry, or green, forage, rich in protein.

The farmers of Cumberland and Westmoreland are convinced of the advantage of breeding dual purpose Shorthorns. In the opinion of these breeders, specialized herds need particular care and are very expensive to keep. Further, beef and milk are too valuable as human food to be sacrificed to each other, when it is possible to obtain both from one animal. An over-specialized cow is not adapted for breeding, as if she is a heavy milker the calf is often fattened and sent to the butcher in order that the dam's milk can be sold.

III.—The author applies the conclusions reached in the preceding article to the situation of cattle breeding in the United States. He is inclined to believe that the present agricultural crisis will have the effect of causing the farmers to return to mixed cultivation, as specialization only increases their risks. On these mixed farms, many dual purpose cattle will be bred, although of late, there has been a tendency to breed dairy cows chiefly. The consumption of milk may be expected to fall with the increased meat consumption therefore it will be profitable to rear stock producing both milk and beef. The elements for forming herds of dual purpose animals are to be found in the Shorthorn, Red Poll, Devonshire and Brown Swiss breeds. If the author had to start such a herd, he would choose good milkers from the Milking Shorthorn and Beef Shorthorn varieties, and purchase the best dual purpose bull (out of a very heavy milker) he could obtain. He would then proceed to improve the herd's milk and beef production by making every effort to breed large strong cows of beef cattle type.

If the herd was already established, he would procure one dual purpose bull and another bull belonging to the beef breed, such as the Shorthorn, Aberdeen Angus or Hereford. The first bull would sire calves intended for breeding purposes, and the second the calves to be sent to the butcher.

IV.—Anyone attempting to breed Shorthorns solely for milk, or only for beef-production, is working against the hereditary tendency of the breed, and thereby loses half the yield of the animals and forfeits half the profit he might obtain from them.

At the present time, dual purpose cattle are greatly needed to fertilize the crops of the maize, cotton, and wheat belts.

V.—Until 1916, Red Polls did not thrive in England. This was largely due to the fact that few breeders owned animals with the typical characters of the breed. Since that time more care has been taken to obtain cattle true to type. Many large herds, among which must be mentioned the Gressenham herd, were broken up. Animals with Gressenham blood had a great effect in improving the milk yield of a very large number of Red Poll herds.

The author is of opinion that breeders should rear cows of the type of Meadow Ruby, Sudborne, Minerva, Dallinghoo Blossom, Gressenhall Molly, etc., and weed out all animals of inferior quality. Every cow should give 800 to 1,000 gals. of milk, and at the same time retain her fattening capacity. This, however, is not all that is required, for cheap milk and meat are in request. The Red Poll comes from East Anglia where there are many poor pastures, and is therefore characterized by its capacity of fattening on grass of inferior quality, and under unfavourable conditions.

VI.—If a farmer wishes to be successful in breeding Red Polls he must choose the dual purpose type which is more profitable.

The author mentions one herd of Red Polls of which the cows gave annually 800 gals. of milk with a fat content of 4·3 per cent, The bulls produced by these cows turned the scale at about 1,300 lb. when 30 to 36 months old. From the time they were weaned, nearly three months before their sale, these animals had not been fed on any kind of cake or meal.

The Red Poll must not be expected to give too heavy a milk yield. Over 1,000 gals. would be prejudicial to beef production.

To deprive the Red Poll of its dual purpose capacity would mean to lessen the longevity of the breed.

VII.—It is often said that the dual purpose cows ought to be fattened and sold after their 4th or 5th calving, as their defective constitution does not permit of their producing enough milk. The author, however, mentions many Red Poll cows which when already advanced in age still yielded a large quantity of milk. 8430 Daffodil gave 920 gals. annually after her 10th calf; 1117 Daffydowndilly 940 after her 9th; 12619 Meadow Blush 2nd 792 gals. after her 12th; 17126 Meadow Blush yielded during her 15th year 930 gals. of milk; 17209 Flodmore Ruby when between 6 and 14 years of age, gave on an average 1,218 gals. of milk and when 16 years old, while Kitchener Daffodil gave 870 gals. of milk after her 16th calving.

X.—The great problem of breeders of dual purpose cows is the maintenance of an equilibrium between milk yield and meat production. The feeding of the heifers is of paramount importance in this connection. As production is correlated with assimilative capacity, it is necessary to aim at increasing the latter. The author recommends the following system of feeding young stock.

Whole milk must only be given to a calf after the first week, after which time it must be gradually replaced by skim-milk, so that when the animal reaches the age of three months it is given no whole milk. To the skim-milk may be added "grains" (oats, maize and bran) as well as hay. This diet develops the absorption capacity. Hay plays an important part in the feeding of heifers. The best hay is obtained by sowing a mixture of meadow clover (*Trifolium pratense*), Alsike clover (*Trifolium hybridum*) and Timothy grass (*Phleum pratense*).

This system of feeding should be continued throughout the growing period and until the time the heifer is sexually mature. The author advises that heifers intended for breeding purposes should be mated directly they are full-grown, before they have lost their feminine shape, and their flesh becomes hard. As soon as they are in calf, they should be fed more liberally, in order to encourage the growth of the foetus and the development of the dam.

82.—**Pork Production.**—Voitelier, Ch. *Revue de Zootechnie*, No. 12, pp. 187-210, figs. 7, tables 3. Paris, 1922.

The fluctuations in the price of pork are largely due to ignorance of the quality of meat most in demand, and of the food necessary to obtain a first-class product.

For the last fifty years, the consumption of fresh pork has increased at the expense of salt pork. The relative value of lard as compared with lean meat has fallen.

The author is of opinion that a larger consumption of bacon, viz., of slightly salted meat from which the salt is removed before the smoking process, would be most advantageous to the pig-breeding industry. For bacon of the best quality it is necessary to have pigs weighing from 88 to 130 lb. and giving meat with a relatively small amount of fat.

In the meanwhile, however, it is imperative to produce the articles most in demand *i.e.* fresh pork and salted pork.

The results of experiments conducted at the Wisconsin Experiment Station have proved that the nutritive value of the meat of young animals is less than that of older pigs, but the money value is not proportionate to the nutritive value. One pound of rather lean meat containing sufficient fat to be savoury, fetches a higher price than one pound of fat meat.

On the other hand, it has been found that the pig's power of assimilating nitrogenous substances decreases regularly with age; further, the yield of a young pig given an insufficient amount of milk from its birth, is lower than the yield of an animal that has been more liberally fed.

From experiments carried out twenty years ago in Denmark, it appears that there is an optimum age for slaughtering young pigs after they are weaned. The determination of the right moment depends upon the net cost per pound of meat and the condition of the market.

The method of rearing swine plays a great part in the growth of the animals in determining the quality of their meat. The author believes that rearing pigs out-of-doors can only have a favourable effect upon the quality of the pork especially in the case of pigs sent to the butchers when they weigh 130 lbs.

From these data, the author draws the following conclusions respecting the technique for: (a) producing pork to be consumed fresh. The pigs should be slaughtered at the age of 6 to 9 months. They should be intensively fed, no change being made in

their diet at the time of weaning, so that they may develop as rapidly as possible. The ration must have a nutritive ratio of between I : 4 and I : 5, the best foods being cereal "grains," manioc, artichokes and skim-milk; (b) for producing salt pork: In order that this may be remunerative only cheap foods must be used, grain offal, residues, household scrap, etc. Store pigs from 6-8 months old which are vigorous and thrifty make the best use of such foods. If they are fed for the three months before they are killed upon foods that will improve the quality of their meat, they can be sold profitably, provided their weight does not exceed 220 lbs.

232.—**Composition and Nutritive Value of Green Forage Silage.**—HANSSON, NILS. *Kungl Landbruks Akademiens Handlingar och Tidskrift*, No. 5, pp. 413-434. Stockholm, 1922.

The experiments with forage crops described in this publication in addition to the results noted in the *Comptes Rendus de l'Institut Central de recherches agricoles* (No. 221) have led to the following conclusions:

(1) Leguminous forage crops and hay if silaged carefully, form a valuable feed for milch cows.

The most satisfactory results have been obtained with fresh green silage consisting of 30 to 50 per cent leguminous plants, cut when well matured, *i.e.*, when the pods are fully developed.

The forage should be well chopped up and stacked in such a way as to allow free circulation of air. The damping of forage which contains a large amount of dry matter, owing to undue desiccation, and the watering of the upper layers in the silo, helps to exclude the air and encourages good fermentation.

(3) The composition of the silage remains unchanged before and after ensilage. However, owing to moisture evaporation, the content of dry matter increases and certain modifications take place in the composition of the nitrogenous and fatty content (ether extracts).

A large proportion of the albuminoids are transformed into peptones and amino acids, and owing to their solubility, finally become changed into amides, retaining however, their former value as albuminoids. Even in cases where fermentation took place under the best conditions, about 10 to 20 per cent of the total nitrogen content of the forage was transformed into ammonia and was consequently lost.

During fermentation in the silo, the sugar and the carbohydrates gave rise to considerable quantities of organic acids, partly fatty acids, lacking however the nutritive value of fats. Certain samples of silaged feed considered as quite satisfactory, possessed on analysis up to 1 per cent free acids. On the other hand the presence of butyric acid indicates a badly made silage.

(4) Green silage has a favourable influence on milk production; the effect on the fatty content of milk may be compared with that of neutral forages.

(5) When the silage is well made, 14·3 lb. of silage consisting of 30 to 50 per cent leguminosae, or 15·4 to 16·5 lb. of hay corresponds to 1 food unit.

These two feeds contain 1·75 to 1·80 gm. of dry matter. These figures should be higher in the case of oats and barley silage, or if the silage has not been made successfully.

(6) For milch cows, the fresh silage forms an excellent winter feed and may be used to substitute fresh fodder, at the rate of 33, 44 or 55 lb. or more per cow per day. Thanks to the high content of dry matter this may also serve to a certain extent to replace straw. Green silage, well turned, contains 3 to 5 times more albumin than the roots of forage crops.

(7) Green silage has a dietetic value and has a slight laxative effect.

(8) Certain inconveniences are however associated with cheese making, more especially in cases where full ripening is necessary. The cheeses made with milk from cows fed on silage often ferment to excess and exude a large amount of gas.

262.—**Turkey Breeding in Missouri (U.S.A.)** —MCMAHAN, J. C., *Monthly Bulletin of the Missouri Board of Agriculture*, Vol. 20, No. 9, p. 19. Jefferson City, 1922.

The author gives some advice, based on his own experience on the subject of turkey-breeding. Ten acres of land are enough for one pair of turkeys; 4 turkey-hens and one turkey-cock can be kept on 15 acres and 8 turkey-hens and one turkey-cock on 20 acres. Fifteen turkey-hens can be allowed to run with one cock, but it is better to limit the number of females to 12. Turkeys should not be shut up, all they need is a shelter in which to take refuge in bad weather. The author used sodium chloride as a remedy against fleas in the birds, but if the parasites are very numerous, it is not sufficiently strong; recourse must be had in such case to the following mixture: carbolic acid, 1 oz., coal oil, 5 pints, tar oil, 10 oz. This mixture is to be applied, after thorough shaking, to the inside of a box sufficiently large to contain a turkey-hen. One turkey-hen is then put in, and the box covered with a sack. The sack can be removed after 20 minutes when it will be full of insects, while all those remaining on the bird will be killed. Turkey chicks cannot be treated in a similar way.

Turkey-hens lay on an average 17 to 20 eggs, but by good feeding, the number can be increased to 25.

The eggs should be collected twice a day at the beginning of the season, by a person with clean hands. The author does not advise that the collector should wear gloves. The eggs are kept in a basket and should be turned once every two days.

Turkey-hens must have a varied diet if they are to lay well. If no green food is available, they may be fed lucerne meal, or ground clover meal, soaked over night. In order to have yolks of good colour, green food is absolutely necessary. The author attached much importance to the use of bran, oat meal and wood charcoal which should be given *ad. lib.* to the birds in addition to their daily ration. Charcoal purifies the blood and keeps the liver in good condition. Hot food is not necessary, but if water is added to the ration, it should be warmed.

The turkey-hen begins laying at the end of February, or early in March. In order not to lose the eggs, it is well to affix a small bell to the bird's neck, and then it can be tracked easily to its nesting place. It is advisable to notice what attracts turkeys that prefer laying outside the poultry-yard.

When many birds are kept, a shed should be built for them. The author's turkey-house is 14 ft. long with boarding 4 ft. high at the ends and wire-netting 7 ft. 6 in. high in front. The shed is divided by movable partitions that can be replaced in bad weather by perches.

When it is impossible for a turkey-hen to sit where she has laid her eggs, the author makes a nest for her in a barrel. Before putting the bird on the nest, it is best to fumigate it and powder it over with insecticide. After a week the turkey-hen should be again examined for parasites as they attach themselves readily to the chicks.

The sitting turkey-hen should have always at its disposal some oatmeal, charcoal and water. Once a day a little maize is fed.

When a turkey-hen becomes broody, she is put on twenty eggs in a nest, and at the same time, a setting of nine eggs each is placed under nine young turkey-hens. As soon as the eggs have all hatched, the chicks are given to the old turkey-hen. When the young birds leave the nest, they are treated with insecticide, and during the first thirty-six hours are given only a little sour milk to drink. The hen on the contrary, is fed liberally, and is allowed plenty of pure water. The first food given to the young turkeys consists of hard-boiled eggs which are fed every three hours for the first four days, being gradually replaced by crushed oats and prepared foods. The chicks must not be let out in the morning before the dew has disappeared, and if they are caught in shower, must be put into a basket, covered with a cloth or sack, and put to dry near the fire. If any of the birds have caught cold, a little permanganate of potassium is added to their drinking water till they have recovered. Chicks attacked by diphtheria (*epitheliosis infectiosa avicum*) are treated as follows: A mixture is made of 2 oz. petroleum + 2 oz. sweet oil + 2 oz. turpentine + 2 oz. extract of camphor; this is well shaken and injected into the nostrils and upper part of the beak. This remedy is more effective if the bird's head is dipped first into warm salt water.

The author believes that the disease known as Black-Head is produced by the consumption of spilt or fermented food, and that it might be prevented by giving the birds wood-charcoal *ad lib.* At the beginning of the breeding season, the turkey-cocks should be given, in addition to their ordinary food, some maize bread made according to the following recipe: 4½ litres of raw flour + one tablespoonful soda + 2 tablespoonfuls salt + 4 eggs. This is mixed with milk, put into a frying pan, and afterwards into a hot oven.

AGRICULTURAL INDUSTRIES

116.—Loss in the Grain of Maize in Storage as Silage.—GAINES, W. L., *Journal of Dairy Science*, Vol. V, No. 5, pp. 507-509, Baltimore, 1922.

The grain constitutes two-thirds of the nutritive value of the crop and practically its entire commercial value. It is therefore of practical interest to note that maize harvested as silage is associated with the better use of the stalk for feeding purposes.

The loss of dry matter in the grain, harvested and stored in crib and silo during these experiments, which covered a period of eight months, is estimated at 2·25 and 5·08 per cent respectively.

127.—Methods of Measuring the Volume of Cream on Milk.—HARDING, H. A., KELLY, F. W., and CHRISLER, E. S., *Journal of Dairy Science*, Vol. V, No. 5, pp. 468-478, bibliography. Baltimore, 1922.

In the city trade the appearance and volume of the cream on the milk as delivered to the consumer is a matter of considerable commercial importance. This has been recognized by the milk industry and different methods of measuring the cream have been adopted. There is however an almost complete lack of literature on the subject. The authors have made a study of the various methods, and finding that they were not satisfactory for the study of the influence of plant operations on the volume of cream, there has been developed a simple and accurate method of measurement which has been found readily applicable under working conditions.

This method consists in filling round bottomed test tubes 1 inch in diameter, to a depth of 204 mm. with the milk to be tested. The tubes are cooled immediately in ice water and then kept in a temperature of 40°F. for approximately 20 hours. The depth of the cream layer is measured in millimetres and each millimetre of cream represents 0·5 per cent of cream by volume. The volume of cream as determined in this way, agrees closely with the volume of cream in milk bottles under similar temperature conditions.

This method has been extensively tested in milk plants and its advantage lies in the fact that by its use a large number of samples may be collected during a single day, the samples stored compactly, and measurement of the cream made quickly, accurately and quantitatively.

128.—Preliminary Investigations on the Acid Content of Milk on the Composition of Butter and on the Oily Taste of Butter.—HAGLUND, E., and Waller, R., *Kunge Landtbruks-Akademiens Handlingar och Tidskrift*, Year LXI, pp. 425-456. 1922.

Towards the end of 1919, the Swedish Bureau of Butter Control reported to the Central Institute for Agricultural Research (Dairy Section) that the butter during the war was of inferior quality and suggested that a special study should be made as to the cause of oiliness, a defect which reduces to a marked degree the value of the butter.

Previous researches have shown that the oiliness was only noticeable in conjunction with sodium chloride and lactic acid. As regards the latter, experiments have demonstrated that this defect occurs only when the acidity of the cream is below 1·3 per cent. The butter content in non-fatty materials and the methods employed in butter making are both important factors in this respect.

The preliminary tests made during 1920-21, with a view to the modification of butter making methods, by artificial fermentation to prevent this unpleasant oiliness has led to the following conclusions:

(1) That in the dairies, the cream should only be churned when the acidity amounts to about 35° Soxhlet-Henkel in the non-fatty portions;

(2) That the churning continue until a very low acidity is reached, giving a butter with the characteristic flavour of artificial fermentation;

(3) That a lowering of acid content of cream improves to a large extent the keeping qualities of the butter.

(4) That the oily flavour of artificially fermented butter may be reduced if the acidity of the cream is also limited.

The experiments also indicate:

(1) That by increasing the degree of acidity of the cream, the non-fatty content of the butter is also lessened and the acidity of the brine is increased;

(2) That by adding equal quantities of lactic acid to the non-fatty portions of creams varying in fat content, the influence on the composition of the butter is nil;

(3) That the careful washing of the butter decreases the non-fatty content and the acidity of the brine;

(4) That if after the butter is washed, it is left in water for two hours, the acidity of the brine is still further decreased.

130.—Actinomyces in Milk With Special Reference to the Production of Undesirable Odours and Flavors.—FELLERS, C. R., *Journal of Dairy Science*, Vol. V, No. 5, pp. 485-497. Baltimore, 1922.

Actinomyces are often present in commercial milk samples. In normal samples these organisms constitute about 2·5 per cent of the total. In abnormal samples, particularly those drawn from cows in dusty stables, this figure may reach 50 per cent.

The principal sources of contamination are hay, straw, grain and soil and dust from these materials.

Under certain conditions actinomyces may cause an obnoxious, bitter-mouldy taste in milk after a few hours of storage.

The two most active species identified were *A. griseus* and *A. albus*. These organisms grow readily in milk and are able to produce marked changes in the casein and whey. The extremely diffusible and volatile substance which causes the odour and taste so characteristic of actinomyces is not known.

Actinomyces may cause stale, musty and mouldy odours in such foods as walnuts, dried fish, cereal grains, and possibly dried eggs. They occur in conjunction with moulds in various food-stuffs, especially those in dried condition.

In studying actinomyces or in attempting to isolate them, the ordinary methods and media with incubation at 37° C, are unsatisfactory; synthetic media should be used together with a long period of incubation at a low temperature.

PLANT DISEASES

308.—Review of the Literature Dealing With "Stipplestreak" and Other Kindred Diseases of the Potato. ATANASOFF, D. A. A., *Medeelingen van de Landbouwhoogeschool en van de daaraan verbonden Institute.* Vol. 26, Part I, pp. 1-52. Wageningen, 1922.

These bibliographical investigations on the diseases of the potato were undertaken

with the object of discovering whether the disease known under the name of "streak," or "stipplestreak" was a new malady.

As a result of his studies, the author reached the conclusion that though stipplestreak has been regarded as a disease of recent origin, it is on the contrary one of the oldest, if not quite the oldest, of the diseases attacking the potato. Further, it is clear that all the modern ideas of a relationship existing between "leafroll," "mosaic" and the maladies formerly called "curl," "Krauselkranheit" and "frisolee" are wholly without foundation, while less time would have been expended on the study of the nature of the affection known as "degeneration" or "running out," if the older literature on the subject had received more careful attention.

In the present review the author has made a concise summary of all that has been published regarding this group of diseases from 1775, the year when this form of degeneration, which still attacks the potato plant in Britain and on the continent of Europe, first began to attract notice. The review mentions some 140 works, and is divided into two periods, one dating from 1775 to 1900, and the other from 1901 to 1922; the first period being treated more exhaustively, as it contains less well-known, or forgotten publications of special interest.

313.—**New Measure for Controlling Apple-Tree Canker (Nectria Ditissima).**—MACINEIRA, F., *El Cultivador Noderno*, Year XII, No. 5, pp. 11-12. Barcelona, 1922.

On an estate situated on the north coast of Spain in the immediate neighbourhood of Cape Estaca de Bares (Galicia), at the mouth of the Sor, many of the most vigorous apple-trees belonging to the choicest varieties, as soon as they are 4-8 years old became seriously and in some cases fatally, attacked by canker (*Nectria ditissima* Tirl.).

The hardy Galician and Russian varieties, on the other hand, not only proved very resistant to the disease, but if they were attacked suffered less; none of the trees, or any large number of the branches, being killed. Therefore it would appear that the best method of protection against canker is to grow only varieties of apple which are least susceptible to the malady.

Since canker made its appearance, various measures have been adopted to save the infected trees.

The cankerous part of the bark of the trunk and main branches were cut away, the wounds being carefully scraped and then disinfected with 50 per cent "zotal," after which the trees were thoroughly pruned.

The trees in which the disease was in the initial stage were sprayed with 15 per cent Bordeaux mixture, after the infected portions and all dead tissue beneath them had been removed, and the wounds were subsequently disinfected.

Spraying with petroleum and "zotal" was also tried, but none of these treatments gave entirely satisfactory and lasting results.

At the beginning of 1918 an experiment of quite another kind was made. Three vigorous apple-trees of five or six years of age, which had been severely attacked by canker were chosen. Their large lower branches were cut away near the base, the cut being made in an horizontal direction, and the surface was scooped out with a gouge, so as to form a small groove at the end of the mutilated branch. A little copper sulphate (the exact amount was not noted) was dissolved in about half a litre of water and poured into the groove which was then covered over with a piece of canvas tied on with string; a further quantity of the solution was added every eight to ten days to replace the amount absorbed by the tissues. In addition, the large wounds on the trunk and on the remaining branches were treated, all the dead portions excised, and the cuts brushed over with very strong Bordeaux mixture. This first attempt was crowned with success. The old canker sores did not extend any further, and five years after the operation there was no sign of the reappearance of the disease, the trees producing a heavy crop of excellent fruits.

This experiment with some modifications was repeated in 1921, on five other apple-trees seriously attacked by canker. In the trunk of each of them a hole of small diameter and with a slope of about eighty degrees, was bored by means of a gimlet and gouge at a height of one to one and a half metres from the ground. Then a little cup was made with grafting-clay at the entrance of the hole. From March 12 to April 27, a solution of 200 gm. of copper sulphate in 2 litres of water was gradually introduced through the cup into the cavity, more being gradually added as it was absorbed by the tree, and the hole carefully covered with a piece of canvas. The trees were thoroughly pruned and all their canker wounds treated.

Four or five months after this operation a narrow longitudinal lesion appeared in the bark, and the latter became dry from the site of the perforation almost to the level of the ground. This lesion was probably caused by the strong concentration of the solution injected. Perhaps it would be advisable to use a 4 per cent or even weaker solution, instead of the 10 per cent solution. Apart from the above-mentioned cortical lesion, three of the trees have so far remained healthy and bear vigorous shoots and fine crops of apples. The fourth tree produces less strong shoots, while the fifth which was very sickly at the time of the experiment, although it developed no lesion of the cortex, has withered in consequence of root-rot.

A simple and effective means of combating canker is to make an incision down the

trunk in the spring and along the chief branches, on the most sheltered side of the strongest-growing apple-trees, as these are the most susceptible to canker. Trees thus treated are less likely to be infected with canker, or even if the disease attacks them, it assumes a mild form, while the young shoots of diseased trees which have been incised grow very strong and remain perfectly healthy.

It has been found that the best substance to apply to all wounds on fruit-trees, and especially those due to apple-canker, is a thick-paste made of crude sardine-oil (from the pickling-factories) mixed with powdered ferric oxide. This must be applied with a brush and trowel after the wounds have been cleaned and freed from all remains of cankerous growth.

OTHER ARTICLES ON SCIENCE AND PRACTICE OF AGRICULTURE

On account of lack of space the following articles in the International Review of the Science and Practice of Agriculture can only be referred to. Anyone desiring the articles may obtain them from the Institute Branch, Department of Agriculture, Ottawa.

Agricultural Education in Norway.—BJANES, O. T., in *International Review of the Science and Practice of Agriculture*, January-March, 1923, pp. 1-12.

The Bacteriology of Agricultural Soil and Its Difficulties and Fallacies.—ROSSI, G., in *International Review of the Science and Practice of Agriculture*, January-March, 1923, pp. 13-23.

New Forms in the First Generation of Animals.—FRATEUR, J. L., Director Zootechnical Institute, Louvain, Belgium, in *International Review of the Science and Practice of Agriculture*, January-March, 1923, pp. 43-48.

Agricultural Technique and Farm Engineering in Germany.—NUSSBAUM, S., in *International Review of the Science and Practice of Agriculture*, January-March, 1923, pp. 49-60.

1.—The Weather and Crops in Eastern England, 1885-1921.—HOOKER, R. H., in *The Quarterly Journal of the Royal Meteorological Society*, Vol. XLVIII, No. 202, pp. 115-138. London, 1922.

10.—The Value of the Waste Lime From the Cellulose Industry for the Fertilization and Improvement of the Soil.—VON FEILITZEN, H. J., *Kungl. Landtbruks-Akademiens Handlingar och Tidskrift*, Year 71, No. 7, pp. 567-587. Stockholm, 1922.

11.—The Effects of Acids and of Alkaline Fertilizers.—HUDIG, J., and MEYER, C., in *Verslagen van landbouwkundigeson derzoekingen der Rijkslandbouw proefstations*, No. XXVI, pp. 60-86. Gravenhage, 1922.

29.—Effect of Cupric Treatments on the Wheat Yield.—MORETTINI, A., *Le Stazioni sperimentali agrarie italiane*, Vol. LV, Pts. 7-8-9, pp. 265-277. Modena, 1922.

30.—Potential Wheat Production Lost in the United States.—*Weather, Crops and Markets*, Vol. II, No. 24, pp. 497-507. Washington, D.C., 1922.

35.—Cereals Grown in Combination for Grain Production.—ZAVITZ, C. A., *Journal of the American Society of Agronomy*, Vol. 14, No. 6, pp. 225-228. Geneva, N.Y., 1922.

39.—Selection of Fibre Flax in the United States.—I. MILES, F.C., *United States Department of Agriculture, Farmer's Bulletin* 669, pp. 16. Washington, D.C., 1922 (revised). II. DAVIS, R. I., *United States Department of Agriculture, Bulletin* No. 1092, pp. 23. Washington, D.C., 1922.

52.—Factors Influencing the Profitable Production of Tomatoes for the Early Market and Canning Factory, and Cost of Production.—JONES, H. A., *University of Maryland Agricultural Experiment Station Bulletin* No. 248, pp. 153-186. College Park, Md., 1922.

71.—Food Value of Cocoanut Cakes, Cocoanut Meal and Ground Linseed for Dairying.—HANSSON, N., in *Kungl. Landtbruks-Akademiens, Handlingar och Tidskrift*, No. 6, pp. 497-519. Stockholm, 1922.

79.—The Richness of Jersey Milk.—*Live Stock Journal*, Vol. XCVI, No. 2598, p. 512. London, 1922.

88.—The Expediency of Introducing Rainbow Trout Into the Public Waters in Switzerland.—VOGLIA, M., *Bulletin suise de peche et de pisciculture*, Year 23, No. 3, pp. 35-37; No. 4, pp. 53-55; No. 5, pp. 74-76. Neuchatel, 1922.

110.—**Automatic Uncoupling Apparatus for Tractors.**—DESSAISAIX, P., *Journal d'Agriculture Pratique*, Year 86, No. 50, pp. 500-502. Paris, December 1922.

111.—**Electric Windlass With Speed-Reducing Anchoring Pole.**—SOURRISSEAU, T. H., *Journal d'Agriculture pratique*, Vol. 38, No. 46, pp. 418-421; *Ibidem*, No. 47, pp. 438-440. November, 1922; *Ibidem*, No. 48, pp. 459-461. December, 1922.

120.—**Investigations Into the Cause of Waste of Exported Citrus Fruits in South Africa and the Best Methods of Storing, Packing and Transport.**—THOMSON, M. R. H., PUTTERILL, V. A., and HOBSON, G., in *Union of South Africa Department of Agriculture, Bulletin* No. 1, pp. 1-69. Pretoria, 1922.

129.—**The Copper Content of Cow's Milk.**—SUPPLEE, G. G., and BELLIS, B., *Journal of Dairy Science*, Vol. V, No. 5, pp. 455-467. Baltimore, 1922.

140.—**Experimental Tests With "Uspulun" and "Supersolfo" in the Control of Smut on Wheat.**—Information provided by Professor Eriksson transmitted by Baron C. N. D. de Bildt, Delegate of Sweden at the International Institute of Agriculture.

THE INTERNATIONAL REVIEW OF AGRICULTURAL ECONOMICS

The following is a brief summary of the contents of the more important articles in the April-June number of the Institute Bulletin. Persons interested in any of the articles may obtain the original Bulletin on application to the Institute Branch, Department of Agriculture, so long as the supply for distribution is not exhausted.

New Legislation on Chambers of Agriculture in Germany.—11 pages. As a consequence of the political changes resulting from the war fresh legislation was introduced to bring about certain modifications in the Chambers of Agriculture already in existence in the States of Germany. This article gives the legislation in Prussia, Bavaria, Wurtemburg, Baden, Oldenburg, and Mechlenburg-Strelitz.

The Cultivation of Allotments in England and Wales During the War.—48 pages. The encouragement of allotments in England and Wales was an integral part of the food production campaign. It alleviated the labour difficulty which pressed so heavily on agriculture, since the work was done by allotment holders in their spare time. By intensive cultivation of land previously vacant, or at least less intensively cropped, allotment holders made a substantial addition to the food supply. The number of allotments increased during the war from 580,000 to 1,400,000. The present article deals with the origin and development of the allotment movement, the movement before the war, the methods by which land was provided, the war period, legislative measures, the work of the Food Production Department for the encouragement of allotment cultivation, war food societies, the work of children, cultivation of the land by British troops, and the results achieved.

Share Tenancy in Roumania.—16 pages. This article deals with the subject under the following heads: origin of share tenancy in Roumania; relation between peasants and landowners after the emancipation of the serfs; share tenancy under the law of 1908; the agrarian reform of 1919 and its effects on share tenancy; share tenancy in 1922.

Land Settlement in the Argentine Republic.—23 pages. Land settlement in the Argentine Republic is among the factors mainly instrumental in bringing about the rapid transformation of the earlier and poverty-stricken Vice-Regency into the wealthy agricultural and stockbreeding country of to-day. The present article gives a history of land settlement in Argentina, a summary of the legislation on the subject and its effects, an account of the work of the railways, and of the present situation with regard to land settlement.

Land settlement as carried out to-day in the cultivable lands that are State property has no longer the character of settlement initiated, encouraged and supported by the Government, but is rather colonization of a less regular kind, tolerated in the first instance and afterwards legalized by the Government, taking the form of subdivision of land previously cultivated and its grant on liberal terms to its cultivator or occupier.

The process of forming these settlements is as follows: When public cultivable lands become capable of economic use by the construction of roads and railways which afford means of disposing of their products, they are at once taken up by squatters (*intrusos*), who settle in such a way as not to interfere with one another and so carry out the subdivision that each one holds a lot of 100 hectares (250 acres). The settlements being thus formed, the occupiers till

the land and introduce capital in the form of fixtures and improvements such as houses and outbuildings, wire netting, wells, etc. In these circumstances it becomes essential to the progress of the new colony and of the country at large that the Government should legalize the position of these squatters by arranging for the official creation of the colony and by granting the lots to their respective occupants. It is in this way that there have been formed in the National Territories, more particularly in those of the North, the greater number of the agricultural colonies which exist to-day in full activity and production.

As moreover the population of the existing colonies is continually increasing and new immigrants arrive in the country, the process of settlement of the uncultivated public lands and the springing up of agricultural colonies is a permanent phenomenon which from time to time makes necessary a Government measure regularizing the situation.

Such a measure was the latest Decree of the Executive, dated 11 July, 1921, which in laying down provisions for the foundation of farm and pastoral colonies and townships within the total area of 18,895,000 acres, not only ordered the creation of these colonies but also conferred legal existence on and regularized the position of thousands of squatter settlers who by their work have transformed the desert into rich zones of agricultural production.

Measures Taken to Facilitate Agricultural Co-operation in the United States.—8 pages. The outstanding measure, during recent years, to facilitate agricultural co-operation in the United States is the Capper-Volstead Co-operative Marketing Law enacted in February 1922. It authorizes farmers and others engaged in the production of agricultural products to act together in associations for the purpose of marketing their products collectively in interstate and foreign commerce. The enactment of the law has furnished a new impetus to the co-operative movement.

The article gives an account of the Cotton Futures Act, the Warehouse Act 1916, the Federal Farm Loan System, etc., and concludes with a statement of the scope and extent of agricultural co-operation in the United States.

Other articles in the April-June number of the International Review of Agricultural Economics are: The Dairy Association of Austria; Agricultural Co-operative Credit in the French Colonies; the German Agricultural Co-operative Societies in 1921-22; the Development of the Raiffeisen Rural Banks in Switzerland; Proposals for the Provision of Additional Credit Facilities in Great Britain; the Progress of Home Colonization in France; the Organization of the Land Departments in Syria and Lebanon; and the Work of the British-Australasian Wool Realization Association.

CO-OPERATIVE LIVE STOCK SHIPPING ASSOCIATIONS IN THE UNITED STATES

(A summary of Farmers' Bulletin No. 1292, U. S. Department of Agriculture)

Although it has long been a common practice in the United States for neighbouring farmers to make joint arrangements for the shipping of their live stock by rail, the development of the organized co-operative live stock shipping movement was long delayed. The first live stock shipping association was formed in 1883; the second not until 1904. Even during the next ten years development was slow and was confined almost entirely to the States of Minnesota, Wisconsin, and Iowa. In 1917, however, a period of rapid development began; at the present time it is estimated that there are between 4,000 and 5,000 producers' organizations which undertake the co-operative shipping of live stock. The movement has made the greatest progress in the Corn Belt and Middle Western States.

In many cases producers' organizations formed for other purposes have undertaken the shipping of live stock for their members in addition to their other activities; but associations formed specially for live stock shipping usually confine themselves to that work. In some States, particularly in Ohio, "county-wide" associations have recently been formed. This type of organization embraces the county as a unit and is directed by a county manager.

The co-operative shipping of live stock enables small farmers, who would otherwise be unable, to send their stock to a central market for sale, and is of considerable benefit even to large farmers. Owing to the fact that the local demand for live stock is limited, the advantages of selling in a central market are very great; local prices, especially for stock of inferior quality, are appreciably lower than those ruling in the central markets. Shipping associations make arrangements for the sale of the stock as well as for the actual transportation; since the stock is handled in bulk the total marketing expenses per head are kept very low. Farmers are safeguarded against deaths or injury among their stock during transit by being entitled in such cases to compensation

from the association; a fund for this purpose is provided by the association by an assessment upon all live stock shipped by it. The usual amounts deducted are 2 to 3 cents per 100 pounds weight on cattle and 3 to 4 cents per 100 pounds weight on hogs, sheep, and calves. The most equitable method is to deduct a certain percentage of the net proceeds.

Co-operative shipping facilities, moreover, enable a farmer to sell his stock at the most advantageous time both as regards the stock itself and the market. The stock can be sold in large or small quantities when it is in its most saleable condition and at a time when prices are good; otherwise when selling is delayed there is a great probability that either the stock or the market will suffer a decline. The most important advantage, however, which a producer derives from a co-operative live stock shipping association is the knowledge which he gains as to the needs of the market. He can compare the market prices of the different breeds or grades of stock and can determine the actual differences; he can then breed or fatten his stock accordingly. In this way the existence of a live stock shipping association has resulted in raising the standard of the live stock in whole districts.

A live stock shipping association may be formed with or without capital stock. The non-stock form of organization is usually the more desirable though this form cannot be adopted in those States where provisions have not been made for the incorporation of such associations. It is advisable for all organizations to be incorporated, since incorporation gives them a distinct legal status which cannot be otherwise obtained and, further, frees the members from liability for the debts of the association.

Very little capital is required for the working of a shipping association; an association ought never to buy or speculate in live stock or to make payment for the animals shipped until the proceeds from their sale have been received. In the case of non-stock associations a small membership fee is sufficient to provide for any necessary initial expense. If the association is formed with capital stock the share value need not be very great; the possession of a large amount of capital may, in fact, be disadvantageous by causing the association to depart from co-operative methods. Usually no surplus fund is accumulated, but where there may be a surplus it can be divided among the members in proportion to the amount of stock shipped by each through the association.

A president and board of directors, usually about seven in number, are appointed from among the members to control the general management of the association. A manager is appointed to take charge of the actual work. Since the success of a live stock shipping association depends to a great extent upon the manager it is imperative that the manager possess a thorough knowledge of business principles and methods as well as of live stock production and marketing. Further, he must possess the confidence of the farmers and must grasp the spirit of co-operation. The manager makes all arrangements necessary for the marketing of the live stock of the members. He orders the railway cars necessary for the stock and is present at the loading to receive, mark, and weigh the animals, and to see that they are properly loaded. The manager determines the market and the commission firm to which the stock is consigned.

The two general methods of selling stock, shipped co-operatively, in a central market are according to individual ownership and according to grade. The advantage of the former is that each farmer receives the exact value of his stock on the day of sale, but on the other hand an extra commission charge is made owing to the increased handling required by the stock at the market. An efficient system of selling stock by grade, however, also insures correct returns being made to each owner, and at the same time avoids the extra expense of sorting the stock and the loss of weight of the stock caused by such sorting. Further, in some markets dealers buying stock for immediate re-shipment to centres further East prefer to buy stock in bulk.

The prorating, or apportioning, of expenses, on co-operative shipments is done either by the commission firm selling the stock or, more desirably, by the manager. A specified rate per 100 lbs. weight or per car of stock is deducted from each shipment to cover the manager's commission and the various expenses, and to provide the protection fund. The manager is usually paid according to the amount of stock shipped iustead of receiving a fixed salary. His commission varies among different associations from 4 to 10 cents per 100 pounds weight of stock shipped; some associations, however, pay him a specified amount per car. The manager receives from the commission firm the proceeds from the sale of the stock; after deducting expenses he distributes it to the individual members concerned.

In a movement so extensive as the co-operative live stock shipping movement some failures are inevitable. Failures are due not to any defects in the system but to defects in the working of individual associations. The chief causes of failure are incompetence on the part of the manager, and disloyalty on the part of the members or failure to give the association their full support. In many instances members of a shipping association are unwilling to allow a manager a fair compensation for his services; in consequence managers of inferior ability

only can be obtained and the business of the association accordingly suffers. The desire of certain members to obtain the manager's position has frequently caused the break-up of an association. In some cases associations have failed because they have been organized in districts where existing local marketing facilities were adequate and satisfactory. There have also been instances where the interests of live stock shipping associations have suffered as a result of the association being used to strengthen or develop other organizations.

The extensive development of the co-operative live stock shipping movement during the last few years shows that the advantages of the system are being more and more appreciated by farmers. As a result of the movement the quality of the live stock of United States no less than the facilities for marketing the stock will be considerably improved.

AGRICULTURAL STATISTICS

THE WORLD'S CEREAL CROPS OF 1923

OCTOBER 18, 1923

Since our communication published in the September-October number of the Agricultural Gazette at page 484, the International Institute has received important additional data or modifications of data previously published, and we are enabled to give in nearly all cases official estimates instead of estimates calculated from acreage and condition of crops. There are presented below official returns to date for the five cereals and potatoes.

In the last issue there appeared a forecast of the total production of wheat in Europe showing an increase of 178,000,000 bushels over last year. The official figures have now been received from all the countries of Europe except Scotland, Ireland, Denmark and Austria, and they show an increase of 219,000,000 bushels over last year's crop and 33,000,000 over that of 1921. Europe's total production is now given as 1,258,000,000 bushels compared with 1,039,000,000 in 1922 and 1,225,000,000 in 1921.

On account of the huge crop in Canada, in spite of the decrease of over 80,000,000 bushels in the crop of the United States the total production in North America is 1,252,000,000 bushels against 1,262,000,000 last year.

A cablegram received from the International Institute to-day (October 18) states that the first official estimate of the wheat crop of Argentina to be harvested in December is 248,755,000 bushels compared with 189,047,000 last year, and 180,642,000 in 1921. It may be mentioned in this connection that the first estimate of Argentina's crop last year was 26,000,000 bushels more than the final estimate.

With official estimates received from all but a few countries the world's production of wheat in 1923 is now given as 3,422,000,000 bushels against 3,108,000,000 in 1922, and 3,087,000,000 in 1921, an increase over last year of 314,000,000 bushels and over 1921 of 335,000,000.

Wheat Demand and Requirements

As shown in the table on page 594 there is a decrease of 331,000,000 bushels or 17·6 per cent in Europe's potato crop, with Germany yet to be heard from, and in view of Germany's recent order prohibiting the export of potatoes the crop in that country must be short. This shortage of potatoes, coupled with the fact that there has been a protracted drought in southeastern Europe severely cutting down the areas seeded to the new crop, make it practically certain that Europe will import more wheat this year than was at first expected.

In Jugoslavia and Bulgaria the weather is dry and soil conditions are unfavourable for seeding. In Hungary seeding is proceeding with difficulty on account of the hardness of the soil, and in Sweden the present wheat harvest has turned out much below expectations owing to heavy rains.

These facts make it necessary to revise the table given at page 486 of the September-October Agricultural Gazette showing the prospective imports of wheat and flour in the present grain year. The detailed statement of probable imports is now as follows:

	Million bushels
Great Britain	220
Germany	60
France	40
Italy	85
Belgium	40
Denmark	5
Sweden	13
Norway	7
Netherlands	27
Finland	5
Greece	13
Switzerland	16
Austria	13
Czechoslovakia	5
Spain	8
Portugal	5
Total for Europe	562
Ex Europe	120
Grand Total	682

The supply situation is considerably changed on account of the new large estimates for Canada and Argentina. But there are several factors more favourable to the seller of wheat. The crop of India has turned out to be of poor quality. In south-eastern Europe the long drought endangering the next crops will likely decrease the amount of exports from the Balkans. Russia is exporting very little wheat, and nothing near as much as some experts predicted. The following statement of prospective exports during this grain year is based on the changed situation.

	Million bushels
Canada	300
United States	140
Argentina	150
Australia	50
India	20
Balkans	18
Russia	15
North Africa	7
Total	700

If these exports are realized they will just about supply the demand of 682,000,000 bushels as estimated in the table for imports.

At page 591 tables are given showing the detailed official figures for the imports and exports of wheat and flour during the grain years 1921-22 and 1922-23.

WORLD'S PRODUCTION OF WHEAT.

Countries	1923	1922	1921
	Bushels	Bushels	Bushels
EUROPE:			
Great Britain and Ireland	61,000,000	65,249,000	73,795,000
France	290,477,000	243,317,000	323,470,000
Germany	101,472,000	71,934,000	107,824,000
Belgium	12,589,000	10,615,000	14,495,000
Netherlands	6,678,000	6,063,000	8,425,000
Denmark	11,000,000(a)	9,249,000	11,145,000
Norway	569,000	643,000	972,000
Sweden	9,862,000	9,381,000	12,577,000
Finland	515,000	296,000	280,000
Spain	152,388,000	125,470,000	145,151,000
Portugal	12,964,000	9,782,000	9,418,000
Italy	199,151,000	161,643,000	192,838,000
Switzerland	5,453,000	3,571,000	5,284,000
Luxemburg	522,000	173,000	661,000
Poland	53,381,000	42,451,000	37,410,000
Czechoslovakia	36,537,000	33,621,000	38,382,000
Austria	7,500,000(a)	7,422,000	6,530,000
Hungary	66,418,000	54,729,000	52,716,000
Jugoslavia	61,894,000	44,472,000	51,810,000
Roumania	115,900,000	92,008,000	78,564,000
Bulgaria	38,783,000	37,705,000	42,510,000
Greece	13,356,000	9,553,000	11,170,000
Total Europe	1,258,409,000	1,039,347,000	1,225,427,000
NORTH AMERICA:			
Canada	469,781,000	399,786,000	300,858,000
United States	781,737,000	862,000,000	814,905,000
Total North America	1,251,518,000	1,261,786,000	1,115,763,000
ASIA:			
India	369,263,000	366,985,000	250,356,000
Japan	26,485,000	27,617,000	26,921,000
Total Asia	395,748,000	394,602,000	277,277,000

WORLD'S PRODUCTION OF WHEAT—*Concluded*

Countries	1923	1922	1921
	Bushels	Bushels	Bushels
AFRICA:			
Algeria	38,383,000	18,233,000	33,764,000
Egypt	40,304,000	36,648,000	37,011,000
Morocco	23,549,000	12,894,000	23,220,000
Tunis	9,406,000	3,674,000	10,623,000
South Africa	7,000,000(a)	6,696,000	8,689,000
Total Africa	118,642,000	78,145,000	113,307,000
SOUTH AMERICA:			
Argentina	248,755,000	189,047,000	180,642,000
Chili	23,000,000 (a)	23,815,000	22,179,000
Uruguay	8,000,000 (a)	5,152,000	9,944,000
Total South America	279,755,000	218,014,000	212,765,000
AUSTRALASIA:			
Australia	110,000,000 (a)	107,263,000	132,285,000
New Zealand	8,000,000 (a)	8,500,000	10,565,000
Total Australasia	118,000,000	115,763,000	142,850,000
WORLD'S TOTAL	3,422,072,000	3,107,657,000	3,087,389,000

(a) Estimates based on acreage and condition reports.

IMPORTS OF WHEAT AND FLOUR 1922-23 AND 1921-22

(Flour expressed in equivalent quantities of wheat)

Countries	August 1st, 1922, to July 31st, 1923			August 1st, 1921, to July 31st, 1922		
	Wheat	Flour	Total wheat and flour	Wheat	Flour	Total wheat and flour
	Bushels	Bushels	Bushels	Bushels	Bushels	Bushels
Great Britain and Ireland	180,063,000	31,893,000	211,956,000	173,846,000	40,392,000	214,238,000
France	48,190,000	.....	48,190,000	19,555,000	.....	19,555,000
Italy	117,686,000	.....	117,686,000	100,986,000	.....	100,986,000
Belgium	40,510,000	.....	40,510,000	45,048,000	.....	45,048,000
Germany	34,877,000	3,143,000	38,020,000	69,426,000	1,251,000	70,677,000
Austria	3,965,000	9,021,000	12,986,000	10,530,000	8,210,000	18,740,000
Denmark	3,487,000 (a)	2,390,000 (a)	5,877,000	1,623,000	2,567,000	4,190,000
Greece	11,438,000	4,261,000	15,699,000	12,563,000	667,000	13,230,000
Norway	4,008,000	2,613,000	6,621,000	3,035,000	2,055,000	5,090,000
Netherlands	21,627,000	5,618,000	27,245,000	18,453,000	4,521,000	22,974,000
Sweden	8,440,000	1,029,000	9,469,000	3,715,000	831,000	4,546,000
Switzerland	16,017,000 (a)	.....	16,017,000	13,217,000	.....	13,217,000
Czechoslovakia	1,165,000	10,782,000	11,947,000	1,628,000	9,778,000	11,406,000
Japan	12,887,000	1,205,000	14,092,000	22,248,000	2,567,000	24,815,000
Egypt	58,000	7,404,000	7,462,000	205,000	6,718,000	6,923,000
Other countries	738,000	8,871,000	9,609,000	933,000	5,226,000	6,159,000
Totals	505,156,000	88,230,000	593,386,000	497,011,000	84,783,000	581,794,000
Exports from these countries	3,425,000	13,429,000	16,854,000	7,183,000	10,841,000	18,024,000

(a) 11 months.

EXPORTS OF WHEAT AND FLOUR 1922-23 AND 1921-22.

(Flour expressed in equivalent quantities of wheat.)

Countries.	August 1st, 1922, to July 31st, 1923			August 1st, 1921, to July 31st, 1922		
	Wheat	Flour	Total wheat and flour	Wheat	Flour	Total wheat and flour
	Bushels	Bushels	Bushels	Bushels	Bushels	Bushels
Canada	229,850,000	49,514,000	279,364,000	150,936,000	34,834,000	185,770,000
United States	148,966,000	66,864,000	215,830,000	198,434,000	70,053,000	268,487,000
Argentina	135,438,000	3,791,000	139,229,000	113,706,000	4,273,000	117,979,000
Australia	31,232,000	18,363,000	49,595,000	97,426,000	16,547,000	113,973,000
India	26,320,000	2,542,000	28,862,000	445,000	2,383,000	2,828,000
Hungary	48,000	5,106,000	5,154,000	708,000	8,387,000	9,095,000
Roumania	275,000	1,320,000	1,595,000	2,977,000	517,000	3,494,000
Algeria	2,447,000	.....	2,447,000	5,533,000	.....	5,533,000
Tunis	918,000	.....	918,000	1,815,000	.....	1,815,000
Other countries	.....	1,958,000	1,958,000	.....	806,000	806,000
Totals	575,494,000	149,458,000	724,952,000	571,980,000	137,800,000	709,780,000
Imports into these countries.	23,292,000	3,983,000	27,275,000	35,505,000	4,013,000	39,518,000

RYE, BARLEY, OATS, CORN AND POTATOES

Official estimates of the production of cereals other than wheat have now been received from nearly all the important producing countries of the northern hemisphere. A smaller number of reports have been received for potatoes, some important producers, such as Germany, having not yet furnished estimates. The following tables contain the detailed figures for 1923, 1922 and the average for the five years 1917-21.

Rye.—The total production this year for 25 countries is 924,000,000 against 812,000,000 last year, an increase of 112,000,000 bushels. There are increases in nearly every country of Europe, and especially large ones in Germany and Poland. Canada and the United States have decreases of 6,000,000 and 31,000,000 respectively.

Barley.—There is a grand total of 1,077,000,000 bushels against 940,000,000 in 1922, an increase of 137,000,000 bushels. There are considerable increases in Germany, Spain, Poland, Czechoslovakia, Canada and the United States, and North Africa. Roumania is the only country that shows an important decrease.

Oats.—Here again there is a large increase in the world's total, which is 3,379,000,000 bushels against 2,944,000,000 last year, an increase of 435,000,000 bushels. This large increase is made up mostly by the crops of Germany, France, Poland, Canada and the United States.

Corn.—Very few countries have furnished estimates of their corn crops so far. The European countries reporting show increases, and there is an increase of 131,000,000 bushels in the United States crop.

Potatoes.—This is the only crop that shows substantial decreases from last year, both in Europe and North America. The grand total for the countries so far reporting is 2,044,000,000 against 2,430,000,000 last year, a decrease of 386,000,000 bushels. There are large decreases in Belgium, England, the Netherlands, Poland and the United States.

RYE

Countries	1923	1922	Average 1917 to 1921
	Bushels	Bushels	Bushels
Germany	273,301,000	206,051,000	233,180,000
Belgium	19,538,000	18,284,000	17,982,000
Bulgaria	8,480,000	7,453,000	6,186,000
Spain	28,642,000	26,252,000	26,779,000
Esthonia	6,863,000	5,797,000	5,710,000
Jugoslavia	5,913,000	4,523,000	5,953,000
Finland	10,592,000	7,775,000	9,918,000
France	36,915,000	38,412,000	35,700,000
Greece	2,662,000	2,362,000	3,151,000
Hungary	31,762,000	25,148,000	21,856,000
Italy	6,693,000	5,563,000	5,675,000
Latvia	11,811,000	6,845,000	9,806,000
Lithuania	24,078,000	24,249,000	18,336,000
Luxemburg	409,000	250,000	360,000
Norway	840,000	862,000	955,000
Netherlands	15,393,000	16,884,000	14,387,000
Poland	257,579,000	197,394,000	175,860,000
Portugal	5,372,000	5,294,000	4,392,000
Roumania	10,322,000	9,206,000	9,263,000
Sweden	22,100,000	22,678,000	20,959,000
Switzerland	1,646,000	1,693,000	1,576,000
Czechoslovakia	51,813,000	51,098,000	43,338,000
Total Europe	832,724,000	684,073,000	671,322,000
Canada	26,936,000	32,373,000	11,066,000
United States	64,774,000	95,497,000	70,426,000
Algeria	17,000	4,000	5,000
GRAND TOTAL	924,451,000	811,947,000	752,819,000

BARLEY

Countries	1923	1922	Average 1917 to 1921
	Bushels	Bushels	Bushels
Germany	109,323,000	73,838,000	82,209,000
Belgium	4,223,000	3,438,000	4,306,000
Bulgaria	12,282,000	11,941,000	8,970,000
Spain	105,247,000	77,534,000	86,010,000
Esthonia	4,351,000	6,670,000	4,415,000
Jugoslavia	14,327,000	11,070,000	13,289,000
Finland	4,928,000	4,557,000	5,117,000
France	46,994,000	40,909,000	34,329,000
England and Wales	44,655,000	42,233,000	47,889,000
Hungary	24,196,000	22,170,000	21,540,000
Italy	10,105,000	8,254,000	9,022,000
Lithuania	8,440,000	10,725,000	6,097,000
Luxemburg	129,000	177,000	111,000
Norway	3,849,000	4,483,000	4,916,000
Netherlands	2,922,000	3,196,000	2,683,000
Poland	81,966,000	59,559,000	58,151,000
Roumania	68,614,000	94,780,000	56,430,000
Sweden	12,212,000	13,830,000	11,828,000
Switzerland	570,000	482,000	631,000
Czechoslovakia	55,177,000	46,352,000	42,355,000
Total Europe	614,510,000	536,198,000	500,298,000
Canada	80,357,000	71,865,000	62,351,000
United States	199,251,000	186,118,000	186,854,000
Japan	81,369,000	87,138,000	92,073,000
Algeria	46,316,000	18,805,000	34,886,000
Egypt	11,376,000	11,306,000	11,189,000
Morocco	32,736,000	27,230,000	32,805,000
Tunis	11,482,000	1,837,000	8,102,000
GRAND TOTAL	1,077,397,000	940,497,000	928,558,000

OATS

Countries	1923	1922	Average 1917 to 1921
	Bushels	Bushels	Bushels
Germany	387,465,000	260,374,000	307,725,000
Belgium	34,217,000	33,667,000	30,259,000
Bulgaria	9,461,000	8,606,000	6,429,000
Spain	33,987,000	29,378,000	31,970,000
Esthonia	8,442,000	9,466,000	7,706,000
Jugoslavia	18,216,000	17,197,000	19,364,000
Finland	26,852,000	26,540,000	24,932,000
France	355,271,000	271,311,000	224,531,000
England and Wales	87,136,000	85,240,000	105,347,000
Hungary	23,855,000	21,227,000	20,834,000
Italy	34,366,000	28,673,000	33,701,000
Lithuania	25,165,000	27,240,000	14,962,000
Luxemburg	2,023,000	1,437,000	1,494,000
Norway	10,382,000	12,593,000	14,444,000
Netherlands	22,534,000	18,728,000	20,141,000
Poland	244,624,000	162,469,000	147,025,000
Roumania	55,956,000	86,658,000	63,392,000
Sweden	64,185,000	74,310,000	63,641,000
Switzerland	2,879,000	2,321,000	3,448,000
Czechoslovakia	81,193,000	67,344,000	62,938,000
Total Europe	1,528,209,000	1,244,779,000	1,204,283,000
Canada	531,378,000	491,239,000	436,130,000
United States	1,302,453,000	1,201,436,000	1,272,736,000
Algeria	12,323,000	5,243,000	12,818,000
Morocco	1,084,000	169,000	368,000
Tunis	3,112,000	746,000	3,197,000
GRAND TOTAL	3,378,559,000	2,943,612,000	2,929,532,000

CORN

Countries	1923	1922	Average 1917 to 1921
	Bushels	Bushels	Bushels
Bulgaria	22,007,000	15,479,000	18,616,000
Hungary	53,096,000	48,725,000	40,933,000
Switzerland	165,000	185,000	284,000
Czechoslovakia	10,455,000	9,884,000	9,539,000
Canada	16,376,000	13,798,000	13,629,000
United States	3,021,454,000	2,890,712,000	2,838,160,000
Algeria	275,000	276,000	268,000
Totals	3,123,828,000	2,979,059,000	2,921,429,000

POTATOES

Countries	1923	1922	Average 1917 to 1921
	Bushels	Bushels	Bushels
Belgium	88,852,000	144,454,000	86,126,000
Bulgaria	1,220,000	1,360,000	1,311,000
Esthonia	23,667,000	26,373,000	22,081,000
Finland	18,330,000	16,009,000	19,231,000
England and Wales	97,626,000	149,781,000	122,394,000
Hungary	62,361,000	48,491,000	61,022,000
Luxemburg	4,630,000	7,007,000	5,046,000
Norway	29,267,000	32,699,000	32,728,000
Netherlands	81,947,000	136,623,000	102,388,000
Poland	1,055,213,000	1,221,588,000	635,650,000(a)
Sweden	66,483,000	74,788,000	68,692,000
Switzerland	23,292,000	24,820,000	30,898,000
Total Europe	1,552,888,000	1,883,993,000	1,187,567,000
Canada	87,591,000	92,908,000	110,198,000
United States	401,424,000	451,185,000	381,876,000
Algeria	2,205,000	2,146,000	1,317,000
	2,044,108,000	2,430,232,000	1,680,958,000

(a) The year 1921.

INDEX NUMBERS OF THE PRICE OF WHEAT

Dates	EXPORTING MARKETS				IMPORTING MARKETS					
	Canada Winnipeg — No. 1 Manitoba	*United States* Chicago — No. 2 Winter	*India* Karachi — Karachi white	*Argentina* Buen. Aires — Barletta	*Germany* Berlin — Home grown	*Belgium* Antwerp — Home grown (Markischer)	*France* Paris — Home grown	*Great Britain* London — Home grown	*Italy* Milan — Home grown soft	*Netherlands* Rotterdam — Home grown
Average 1913	100	100	100	100	100	100	100	100	100	100
12 September 1913	98·2	103·6	94·9	107·5	99	98·5	97·8	99·0	92·5	99·8
8 September 1922	117·9	115·5	150·2	137·0	28,724	277·8	275·6	111·5	419·9	95·1
6 July 1923	127·7	115·5	125·6	134·1	4,295,882	555·6	350·1	141·7	393·2	145·0
13 " "	122·2	112·6	121·5	132·9	5,998,983	555·6	349·6	141·7	359·4	137·8
20 " "	122·2	113·3	117·9	131·2	8,896,797	555·6	346·5	141·7	348·8	126·0
27 " "	122·9	108·9	114·6	126·6	19,827,148	479·8	335·7	146·9	341·6	128·3
3 August "	121·7	108·6	112·1	126·6	23,894,255	472,2	306,5	153,1	325,6	135,5
10 " "	123·9	111·4	108·0	128·3	52,364,006	472·2	304·7	127·1	318·5	135·5
17 " "	127·6	115·0	108·8	130·1	55,922,725	459·6	308·8	112·5	322·1	112·8
24 " "	138·5	117·3	113·8	133·5	87,697,001	454·5	308·8	115·6	327·4	118·8
31 " "	134·7	117·6	112·9	135·8	200,813,421	439·4	312·4	112·5	327·4	105·7
7 September "	132·4	122·4	117·0	137·0	559,227,250	444·4	320·5	117·7	323·8	.....
14 " "	120·3	118·0	119·5	137·6	.....	439·4	313·3	115·6	323·8	.....

PRICES AND OCEAN FREIGHT RATES REDUCED TO CENTS

AT THE EXCHANGE OF THE DATES INDICATED

Products, Markets and Descriptions	7 Sept. 1923	3 Aug. 1923	1 Sept. 1922	Aver. 1913
WHEAT (*cents per 60 lbs.*)				
Canada:				
Winnipeg: No. 1 Manitoba	114	105	102	88
United States:				
Chicago: No. 2 Winter	110½	98	103⅜	90¼
Minneapolis: No. 1 North	122	112	107	87⅝
New York: No. 2 Winter	116	111½	116½	97¼
India:				
Karachi: Karachi white	99	96	125	91
Argentina:				
Buenos Aires: Barletta	105	101	117	100
Germany:				
Berlin: Home grown	—	116	95	128
Belgium:				
Antwerp: Home grown	109	117	n.q.	104
France:				
Paris: Home grown	135	134	160	146
Great Britain:				
London: English	114	150	107	104
Liv. and Lond.: No. 1 Man	132	122	132	110
Liv. and Lond.: No. 2 Win	117	113	118	109
Liv. and Lond.: Pacific	128	124	132	111
Liv. and Lond.: Plate	117	115	119	108
Liv. and Lond.: Australian	126	130	141	117
Liv. and Lond.: C. W. Kar	116	116	n.q.	110
Italy:				
Milan: Home grown soft	106	108	139	148
Netherlands:				
Rotterdam: Home grown	—	152	114	115
RYE. (*cents per 56 lbs.*)				
United States:				
Minneapolis: No. 2	64	61	63¾	56⅝
Germany:				
Berlin: Home grown	—	67	72	101
Belgium:				
Antwerp: Home grown	75	76	94	80
France:				
Paris: Home grown	95	n.q.	102	97
Netherlands:				
Rotterdam: Home grown	—	80	89	86

Ocean Rates of Freight and Voyages	7 Sept. 1923	3 Aug. 1923	1 Sept. 1922	Aver. 1913
OCEAN RATES OF FREIGHT (WHEAT AND MAIZE) (*cents per 100 lbs.*)				
Rumania:				
Danube to U. K.	15	16	18	11
Danube to Genoa	13	n.q.	15	10
Canada:				
Canada to U. K.	12	13	14	14
United States:				
New York to Liverpool	7	7	8	10
North. Range to U.K. Cont	12	12	11	13
North. Range to Genoa	15	n.q.	15	20
North Pacific Ports to U.K.	35	37	35	43
Argentina:				
Plate Down River-U.K.	20	20	20	18
Plate Up River-U.K.	21	22	21	20
India:				
Karachi to U.K.	23	25	20	20
Rangoon to U.K.	23	n.q.	22	29
Australia:				
Australia to U.K.	33	n. 33	35	34
COTTON FREIGHTS (*cents per 100 lbs.*)				
United States:				
New York to Liverpool	20	20	35	30
New Orl. to Liverpool	n.q.	n.q.	50	43

LIVE STOCK STATISTICS

ENGLAND AND WALES

Classification	Number		Increase(+)or decrease (−)	
	On June 4, 1923	On June 3, 1922	in number	per cent
Horses	1,281,200	1,340,500	− 59,300	− 4·4
Cattle	5,822,100	5,722,700	+ 99,400	+ 1·7
Sheep	13,831,800	13,438,000	− 393,800	− 2·9
Pigs	2,611,400	2,298,900	+ 312,500	+ 13·6

SPAIN

Classification	Number		Increase(+) or decrea (−)	
	in 1922	in 1921	in number	per cent
Cattle	3,296,573	3,718,189	− 421,616	− 11·3
Horses	594,351	722,183	− 127,832	− 17·7
Asses	1,014,026	1,137,980	− 123,954	− 10·9
Mules	1,069,408	1,294,912	− 225,504	− 17·4
Sheep	19,377,427	20,521,677	−1,144,250	− 5·6
Goats	3,970,656	4,298,056	− 327,400	− 7·6
Pigs	4,228,964	5,151,988	− 923,024	− 17·9
Camels	5,084	4,268	+ 816	+ 19·1

LATVIA

Classification	Number		Increase (+)or decrease (−)	
	Aug. 1923	June 1922	in number	per cent
Horses	338,000	303,000	+ 35,000	+ 11·4
Cattle	899,100	810,500	+ 88,600	+ 10·9
Sheep	1,460,800	1,166,500	+ 299,300	+ 25·8
Pigs	484,000	402,000	+ 82,000	+ 20·4

INDIA

Classification	Number		Increase(+) or decrease(−)	
	December, 1921, to April, 1922	December, 1920, to April, 1921	in number	per cent
Cattle	116,665,370	116,736,303	− 70,933	− 0·1
Horses and ponies	1,683,947	1,696,746	− 12,799	− 0·8
Asses	1,368,376	1,370,614	− 2,238	− 0·2
Mules	75,536	75,703	− 167	− 0·2
Sheep	22,084,579	22,074,566	+ 10,013	0·0
Goats	24,333,133	24,293,873	+ 39,260	+ 0·2
Buffaloes	28,334,899	28,366,767	− 31,868	− 0·1
Camels	409,674	409,612	+ 62	0·0

NEW ZEALAND

Classification	Number		Increase (+) or decrease(−	
	1923	1922	in number	per cent
Horses	331,922	332,105	− 183	− 0·1
Cattle	3,475,449	3,323,223	+ 152,226	+ 4·6
Sheep	22,928,864	22,222,259	+ 706,605	+ 3·2
Pigs	396,648	384,333	+ 12,315	+ 3·2

THE AGRICULTURAL GAZETTE OF CANADA

INDEX TO VOLUME X

Accredited Herd Register 550
Agricultural Appropriations and Legislation, Dominion of Canada, 1923..... 419
Agricultural Appropriations and Legislation, Provincial, 1923:
- Ontario 445
- Quebec 446
- Manitoba 447
- Saskatchewan 447
- Alberta 448
- British Columbia 451
- Nova Scotia 450
- New Brunswick 450

Agricultural Associations, The Work of the Quebec..... 242
Agricultural College Registration 68
Agricultural Development Board, Report of the Ontario..... 161
Agricultural Education Conference 63
Agricultural Instruction Act:
- Its Effect on Rural Citizenship in Manitoba..... 129
- Instruction in Ontario Schools, Federal Assistance to..... 56

Agricultural Instruction Grant, 1923-24..... 517
Agricultural Instruction for Juniors in Ontario..... 547
Agricultural Instruction in Secondary Schools..... 344
Agricultural Instruction in the Public School—Its Place and Meaning..... 58
Agricultural Legislation, Dominion 153, 419
Agricultural Representative Work in New Brunswick..... 543
Agricultural Shows in 1922, Canada's Record at Leading..... 359
Agricultural Societies in New Brunswick—Their Origin and History..... 441
Agricultural Societies of Ontario, The..... 541
Agricultural Society as an Extension Medium, The Saskatchewan..... 50
Agriculture and Domestic Science in Quebec, The Teaching of..... 127
Agriculture, Families of Graduates in..... 351
Agriculture in Alberta, High School..... 453
Agriculture in High Schools, Ontario..... 347
Agriculture in Manitoba High Schools..... 250
Agriculture in Nova Scotia Schools..... 143
Agriculture, Scholarships in..... 266
Agriculture, The Saskatchewan College of..... 48
Apple Sucker (Psyllia mali Schmid) A Fungous Parasite of the Imported..... 16
Appointments and Staff Changes..... 74, 169, 270, 370, 403, 564
Appropriations and Legislation, Dominion of Canada, 1923, Agricultural..... 419
Appropriations and Legislation, Provincial, 1923, Agricultural..... 445–451
Assistance to Marketing, Departmental..... 105
Associations and Societies:
- Acadian Entomological Society..... 171
- Alberta Agricultural Fairs' Association..... 272
- Alberta Cattle Breeders' Association..... 371
- Alberta Co-operative League..... 463
- Alberta Hereford Breeders' Association..... 76
- Alberta Horse Breeders' Association..... 273
- Alberta Poultry Association 271
- Alberta Seed Growers' Association..... 271
- Alberta Sheep Breeders' Association..... 371
- Alberta Swine Breeders' Association..... 371
- Associate Growers of British Columbia, Limited..... 371
- Beekeepers' Association of British Columbia..... 171
- Berry Growers' Co-operative Union of British Columbia..... 371
- British Columbia Ayrshire Breeders' Association..... 272
- British Columbia Berry Growers' Association..... 171
- British Columbia Goat Breeders' Association..... 271

Associations and Societies:
British Columbia Honey Producers' Association 273
British Columbia Poultrymen's Co-operative Exchange 271
British Columbia Stock Breeders' Association 272
British Columbia Veterinary Association 76
Brown Swiss Breeders' Association 273
Canadian Aberdeen-Angus Breeders' Association 273
Canadian Ayrshire Breeders' Association 273
Canadian Co-operative Wool Growers, Limited 371
Canadian Council of Agriculture 371
Canadian Dual-Purpose Shorthorn Breeders' Club 272
Canadian Goat Society 371
Canadian Hackney Horse Breeders' Association 272
Canadian Hereford Breeders' Association 273
Canadian Holstein Breeders' Association 272
Canadian Horticultural Council 273
Canadian Jersey Cattle Club 272
Canadian National Poultry Association 75, 171
Canadian Pony Society 273
Canadian Sheep Breeders' Association 171
Canadian Shire Horse Association 273
Canadian Silver Fox Association 370
Canadian Society of Technical Agriculturists 371, 463
Canadian Standard Bred Horse Society 271
Canadian Swine Breeders' Association 272
Central Canada Veterinarian Association 171
Dairymen's Association of Eastern Ontario 171
Dairymen's Association of Western Ontario 171
Dominion Bantam Association 171
Dominion Shorthorn Breeders' Association 272
Entomological Society of Ontario 171
Farmers' Union of Canada 273
Federated Women's Institutes of Canada 463
Fraser Valley Milk Producers' Association 463
Manitoba Ayrshire Breeders' Club 171
Manitoba Beekeepers' Association 272
Manitoba Cattle Breeders' Association 171
Manitoba Clydesdale Breeders' Club 272
Manitoba Hereford Breeders' Club 272
Manitoba Horse Breeders' Club 171
Manitoba Potato Growers' Association 171
Manitoba Poultry Breeders' Association 371
Manitoba Sheep Breeders' Association 171
Manitoba Shorthorn Breeders' Club 272
Manitoba Swine Breeders' Association 171
Maritime Beekeepers' Association 171
Maritime Poultry and Pet Stock Association 171
National Dairy Council of Canada 274
New Brunswick Beekeepers' Association 273
New Brunswick Farmers' and Dairymen's Association 271
New Brunswick Fruit Growers' Association 371
New Brunswick Sheep Breeders' Association 271
Niagara Peninsula Fruit Growers' Association 271
Nova Scotia Dairymen's Association 273
Nova Scotia Farmers' Association 272
Nova Scotia Fruit Growers' Association 271
Nova Scotia Poultry Association 273
Okanagan United Growers, Limited 172
Ontario Agricultural Experimental Union 171
Ontario Angus Breeders' Association 273
Ontario Association of Fairs and Exhibitions 172
Ontario Beekeepers' Association 171
Ontario Beet Growers' Association 171
Ontario Berkshire Breeders' Society 273
Ontario Cattle Breeders' Association 272
Ontario Co-operative Dairy Products, Limited 76

Associations and Societies:
Ontario Hereford Breeders' Association ... 273
Ontario Honey Producers' Co-operative, Limited ... 371
Ontario Horticultural Association ... 273
Ontario Milk Producers' Association ... 273
Ontario Plowmen's Association ... 272
Ontario Seed Growers' Association ... 272
Ontario Sheep Breeders' Association ... 272
Ontario Swine Breeders' Association ... 272
Ontario Vegetable Growers' Association ... 272
Ontario Yorkshire Breeders' Society ... 273
Quebec Dairy Association ... 76
Quebec Jersey Cattle Breeders' Association ... 272
Quebec Pomological and Fruit Growing Society ... 171
Quebec Society for the Protection of Plants and the Canadian Branch of the American Phytopathological Society ... 172
Royal Agricultural Winter Fair ... 371
Saskatchewan Agricultural Societies' Association ... 272
Saskatchewan Belgian Horse Breeders' Club ... 271
Saskatchewan Cattle Breeders' Association ... 273
Saskatchewan Clydesdale Breeders' Club ... 271
Saskatchewan Co-operative Elevator Company ... 76
Saskatchewan Corn Growers' Association ... 273
Saskatchewan Field Husbandry Association ... 272
Saskatchewan Grain Growers' Association ... 271
Saskatchewan Hereford Breeders' Club ... 271
Saskatchewan Horse Breeders' Association ... 273
Saskatchewan Live Stock Board ... 273
Saskatchewan Percheron Breeders' Club ... 271
Saskatchewan Poultry Breeders' Association ... 274
Saskatchewan Sheep Breeders' Association ... 274
Saskatchewan Shorthorn Breeders' Association ... 271
Saskatchewan Stock Growers' Association ... 274
Saskatchewan Swine Breeders' Association ... 274
Tamworth Breeders' Club ... 273
Union of Quebec Co-operative Societies ... 370
United Farm Women of Manitoba ... 371
United Farmers of Alberta ... 271
United Farmers of Manitoba ... 171
United Grain Growers, Limited ... 172
United Seed Growers, Limited ... 75
United Seed Growers, Limited, Penticton, B.C. ... 171
Veterinary Association of Saskatchewan ... 171
Western Canada Irrigation Association ... 172
Western Canada Live Stock Union ... 371
Western Canadian Society of Agronomy ... 75, 170
Western Grain Dealers' Association ... 172
Western Ontario Poultry Association ... 272
Western Stock Growers' Association ... 371
Women's Section Saskatchewan Grain Growers' Association ... 271
Associations, The Work of the Quebec, Agricultural ... 242
Beef Shipments, Experimental ... 519
Bovine Tuberculosis in Canada ... 24
Bovine Reproduction, Some Pathological Phases of ... 523
Boys' and Girls' Clubs, Saskatchewan ... 138
Boys' and Girls' Dairy Cattle Judging Competition, Saskatchewan ... 54
British Shows, Flocks and Herds, A Visit to ... 543
Bulletins and Pamphlets in the Schools, The Use of ... 147
Butter Substitutes Excluded ... 562
Butter-Scoring Contest, 1922, The Dominion Educational ... 19
Canada, Information about ... 562
Canada's Egg Standards ... 28
Canadian Cattle Marking Order ... 363
Canadian Colonization Association's Land Lists, The ... 561
Canadian Dairy Industry, A Review of the ... 405
Canadian Horticultural Council ... 556

Canadian Horticultural Council Plant Registration Bureau 64
Canadian National Poultry Record Established 165
Canadian Products on the British Market.—The Cattle Embargo 5
Carter Medal Awarded, The 261
Cattle and Beef Exports 71
Cattle and Chilled Beef, Experimental Shipment of 362
Cattle Embargo, The 5
Cattle to Great Britain, The Admission of Canadian Store 154
Cattle to Great Britain, First Shipments of Store 362
Cattle Marking Order, Canadian 363
Cheese Scoring Contest, Dominion Educational 163
Clover Seed, A New Source of 460
Club Work in New Brunswick, Poultry 251
Clubs, Alberta Women's Institute Girls' 52
Clubs, Lantern Slides for Farmers' 166
Clubs, Saskatchewan Boys' and Girls' 138
Colonization Association's Land Lists, The Canadian 561
Competition, Boys' and Girls' Dairy Cattle Judging, Saskatchewan 54
Competitions in the Province of Quebec, Seed Grain 431
College Registration, Agricultural 68
Commodity Co-operation in Ontario 39
Conference, Agricultural Education 63
Conference, Cattle Exporters' 156
Conference, Dominion Live Stock Branch 67
Conference of Experimental Farm Superintendents 265
Conference on the Conservation of Wild Life 161
Congress, World's Dairy 70, 366
Contest, Dominion Educational Cheese Scoring 163
Co-operation in Ontario, Commodity 39
Corn Borer, A Parasite of the 364
Corn Borer in Ontario During the Summer of 1922, The Distribution of the European 31
Corn Borer, The European 365
Courses in Saskatchewan, Short 256
Cow Testing 520
Cow Testing Report 321
Cow Testing Results in British Columbia 342
Crop Improvement, Forage 514
Crop Improvement in Saskatchewan—
I. Work of the Field Crops' Branch of the Provincial Department of Agriculture 234
II. Crop Improvement Work of the Field Husbandry Department, University of Saskatchewan 237
Dairy Cattle Judging Competition, Boys' and Girls', Saskatchewan 54
Dairy and Cold Storage Branch, The 315
Dairy Congress, World's 70, 366
Dairy Herd, Salving a Tuberculous 216
Dairy Industry, The Reconstruction of Alberta's 131
Dairy Industry, A Review of the Canadian 405
Output and Value 407
Manufacture—Character of Dairy Factory Organization 411
Markets and Marketing—Exports and Imports 412
Governmental Regulations and Supervision 415
Dairy Industry, Some Aspects of the Manitoba 45
Dairy Produce Grading 264
Dairy Station Notes, Finch 321
Dairying in Australia and New Zealand 364
Dairying in Australia, Will Investigate 165
Dairying in British Columbia 544
Dairying in Saskatchewan 337
Demonstration Farms of the Quebec Department of Agriculture, The 35
Departmental Changes in Manitoba 546
Destructive Insect and Pest Act, Amendments to the Regulations under the 457
Development of School Agriculture in Alberta 145
Director of Experimental Farms and the Dominion Animal Husbandman visit Great Britain, The 164
Division of Bacteriology at the Experimental Farm, The Creation of the 164

Dominion Educational Butter-Scoring Contest, 1922, The 19
Dominion Educational Cheese-Scoring Contest 163
Dominion Live Stock Branch Conference 67
Early Laying—Its Economic Significance 244
Economics of Irrigation Practice 148, 257, 354
Eggs, Regulations for the Grading and Marketing of, Extended to Domestic Trade .. 456
Egg Standards, Canada's 28
Elevator Screenings, Further Classification of 314
Embargo, The Cattle—The Status of Canadian Products on the British Market 5
Experimental Farm Series, The Dominion:
Nappan, Experimental Farm, The 205
Lacombe, Alberta, Experimental Station, The 428
Scott, Saskatchewan, Experimental Station, The 422
Vancouver Island Experimental Station 305
Experimental Farm Superintendents, Conference of 265
Experimental Shipment of Cattle and Chilled Beef 362
Experiments. Flax 560
Experiments in Tobacco Culture—
I. Tobacco Station, Harrow, Ontario 116
II. Farnham Tobacco Station 118
Exports, Cattle and Beef 71
Exports, Live Stock 560
European Corn Borer in Ontario During the Summer of 1922, The Distribution of the 31
Fair, Provincial Potato 136
Fair, 1922, The Royal Agricultural Winter 124
Fairs and Exhibitions, Report of the Special Committee on 157
Families of Graduates in Agriculture 351
Farm Boys' Camps—What they are and How they Serve the Boys of the Province, The Saskatchewan 140
Farm Congress, International 366
Feeds and Feeding on the Type of Market Hogs, The Influence of 110
Fertilizer Needs Halfway, Meeting the Farmers' 134
Fertilizers, Profits from Manure and 12
Field Crop Improvement in Saskatchewan—
I. The Work of the Field Crops' Branch of the Provincial Department of Agriculture 234
II. Crop Improvement Work of the Field Husbandry Department, University of Saskatchewan 237
Field Crop Insects in Manitoba 333
Finch Dairy Station Notes 321
Finch Dairy Station Report, The 162
Flax Experiments 560
Forage Crop Improvement 514
Fox, Registration of the Silver Black 23
Foxes Entering Prince Edward Island, Quarantine and Inspection of 562
Fruits and Vegetables, Canadian Government Standards for Canned 228
Fruit Drying Project 522
Gift of Certain Breeding Animals to Canada by the British Shire Horse Association. 165
Gift of Shire Horses to Canada 363
Grading, Dairy Produce 264
Grading and Marketing of Eggs Extended to Domestic Trade, Regulations for the .. 456
Graduates in Agriculture, Families of 351
Grape Leaf Hopper Eggs, The Susceptibility of, to Nicotine 230
Grasshopper Campaign, Saskatchewan, Final Report on 55
Grasshopper Control in Alberta 436
Herd Register, Accredited 550
Hogs, The Influence of Feeds and Feeding on the Type of Market 110
Horticultural Council, The Canadian 556
Horticulture, Prairie 309
Illustration Stations in Quebec, The Dominion 212
Imperial Fruit Show, 1923 366
Importation of Nursery Stock 521
Importation of Rams and Boars, Assisted 266
Information about Canada 562
Influence of Feeds and Feeding on the Type of Market Hogs, The 110
Insect Pests of Canada and the United States 365

Insects in Manitoba, Field Crop 333
Inspection of Foxes Entering Prince Edward Island, Quarantine and 562
Inspection and Certification in Canada, 1922, Potato 121
Instruction Grant, 1923-24, Agricultural 517
Instruction in Ontario Schools, Federal Assistance to Agricultural 56
Instruction, Agricultural, in the Public School—Its Place and Meaning 58
International Congress on Cattle Breeding, 1923 167
International Grain and Hay Show—Canadian Awards 166
Irrigation Investigations in Alberta 148
Irrigation Practice, Economics of 148, 257, 354
Lantern Slides for Farmers' Clubs 166
Legislation, Dominion Agricultural 153
Legume Production in Manitoba 232
Library, The 76, 172, 274, 373, 465, 566
Lists, The Canadian Colonization Association's Land 561
Live Stock Branch Conference, Dominion 67
Live Stock Exports 560
Live Stock Outlook in Saskatchewan, The 434
Live Stock Train, Ontario's Better 340
Manitoba Dairy Industry, Some Aspects of the 45
Manufacture and Construction, Mycological Problems in 221
Manure and Fertilizers, Profits from 12
Marketing, Departmental Assistance to 105
Marketing Services, Alberta 240
Medal Awarded, The Carter 261
Meeting the Farmers' Fertilizer Needs Half-Way 134
Milk Facts, Teaching 353
Milk Industry, The Powdered 459
Milk Utilization Service 21
Minister of Agriculture for Manitoba, Hon. Neil Cameron 54
Mosquito Control at Banff, Alberta 218
Mycological Problems in Manufacture and Construction 221
New Publications 79, 175, 276, 371, 464, 565
News Items and Notes 72, 168, 267, 367, 461
Nicotine, The Susceptibility of Grape Leaf Hopper Eggs to 230
Nursery Stock Importation 521
Nut Culture—A New and Interesting Branch of Horticulture 323
Ontario Long Course Schools, The 249
Parasite of the Corn Borer, A 364
Parasite, A Fungous of the Imported Apple Sucker (*Psyllia mali Schmid*) 16
Pathological Phases of Bovine Reproduction, Some 523
Pedigreeing Poultry, A System of 40
"Plant Breeding in Scandinavia" 71
Plant Originations Protected, New 559
Plant Registration Bureau, Canadian Horticultural Council 64
Potato Fair, Provincial 136
Potato Inspection and Certification in Canada, 1922 121
Poultry Club Work in New Brunswick 251
Poultry Keeping in the Province of Quebec, The Progress of 331
Poultry Record Established, Canadian National 165
Poultry, A System of Pedigreeing 40
Prairie Horticulture 309
Prizes at Macdonald College, Winners of Special 367
Progress of Poultry Keeping in the Province of Quebec, The 331
Project, Fruit Drying 522
Quarantine and Inspection of Foxes Entering Prince Edward Island 562
Rams and Boars, Assisted Importation of 266
Refrigeration, International Congress of 366
Registration of the Silver Black Fox 23
Registered Seed, Export Prospects for Canadian 460
Regulations under the Destructive Insect and Pest Act, Amendments to the 457
Report, Cow Testing 321
Report, The Finch Dairy Station 162
Report on Grasshopper Campaign, Saskatchewan, Final 55
Report of the Ontario Agricultural Development Board 161

Report on the Special Committee on Fairs and Exhibitions..... 157
Royal Agricultural Winter Fair, 1922, The..... 124
Rutherford, The Late John G..... 455
Saskatchewan Agricultural Society as an Extension Medium, The..... 50
Saskatchewan College of Agriculture, The..... 48
Seed Board Meeting, Advisory..... 160
Seed for Export, Extension of Grading..... 68
Seed, Export Prospects for Canadian Registered..... 460
Seed Grain Competitions in the Province of Quebec..... 431
Seeds Act, 1923, The..... 522
Scholarship for Extension School Students in British Columbia..... 352
Scholarships in Agriculture..... 266
in Agriculture, Graduate..... 166
School Agriculture in Alberta, Development of..... 145
in Alberta, High..... 453
School, in the Public, Its Place and Meaning, Agricultural Instruction..... 58
Schools, Agriculture in the Nova Scotia..... 143
Schools, Agricultural Instruction in Secondary..... 344
Schools, Agriculture in Manitoba High..... 250
Schools, Federal Assistance to Agricultural Instruction in Ontario..... 56
Schools, Ontario, Agriculture in High..... 347
Schools, The Ontario Long Course..... 249
Schools, The Use of Bulletins and Pamphlets in the..... 147
Screenings, Further Classification of Elevator..... 314
Shipment of Cattle and Chilled Beef, Experimental..... 362
Shipments, Experimental Beef..... 519
Shipments of Store Cattle to Great Britain, First..... 362
Shire Horse Association, The Gift of Certain Breeding Animals to Canada by the British..... 165
Shire Horses to Canada, Gift of..... 363
Short Courses in Saskatchewan..... 256
Show, 1923, Imperial Fruit..... 366
Shows, 1922, Canada's Record at Leading Agricultural..... 359
Shows, Flocks and Herds, A Visit to British..... 534
Societies of Ontario, Agricultural, The..... 541
Soil Fertility, The Influence of, on the Water Requirements of Crops..... 354
Staff Changes, Appointments and.....74, 169, 270, 370, 463, 564
Standards for Canned Fruits and Vegetables, Canadian Government..... 228
Stations in Quebec, The Dominion Illustration..... 212
Status of Canadian Products on the British Market. The Cattle Embargo. The.. 5
Store Cattle to Great Britain, First Shipments of..... 362
Store Cattle to Great Britain, The Admission of Canadian..... 154
Superintendents, Conference of Experimental Farm..... 265
Train, Ontario's Better Live Stock..... 340
Tobacco Culture, Experiments in—
I. Tobacco Station, Harrow, Ont..... 116
II. Farnham Tobacco Station..... 118
Tuberculous Dairy Herd, Salving a..... 216
Tuberculosis in Canada, Bovine..... 24
Vegetable Vitamins..... 558
Vetinary Medical Association, Canadian..... 561
Vitamins, Vegetable..... 558
Water Requirements of Crops, The Influence of Soil Fertility on the..... 354
Water Supply in the Farm House, The..... 440
Wheat and Wheat Flour, Canadian..... 499
Women's Institute Girls' Clubs, Alberta..... 52

PART I

DOMINION DEPARTMENT OF AGRICULTURE

Agricultural Instruction Grant, 1923-24..... 517
Agricultural Legislation and Appropriations, 1923, Dominion of Canada..... 419
Beef Shipments, Experimental..... 519

Canadian Products on the British Market—The Cattle Embargo—
The Status of 5
Dairy Industry, A Review of the Canadian..... 405
Dairy Herd, Salving a Tuberculous..... 216
Fruit Drying Project..... 522
Marketing, Departmental Assistance to..... 105
Wheat and Wheat Flour, Canadian..... 499

DOMINION EXPERIMENTAL FARMS BRANCH

Experimental Station, Lacombe, Alberta, by F. H. Reed, Superintendent..... 428
Experimental Farm, The Nappan, by W. W. Baird, Superintendent..... 205
Experimental Station, Scott, Saskatchewan, by M. J. Tinline, Superintendent..... 422
Experimental Station, The Vancouver Island, by E. M. Straight, B.S.A., Superintendent 305
Prairie Horticulture, by W. R. Leslie, B.S.A., Superintendent, Dominion Experimental Station, Morden, Manitoba 309
Division, Animal Husbandry:
Hogs, The Influence of Feeds and Feeding on the Type of Market, by G. B. Rothwell, Dominion Animal Husbandman..... 110
Division, The Botany:
Manufacture and Construction, Mycological Problems in, by H. T. Gussow, Dominion Botanist 221
Potato Inspection and Certification in Canada, 1922, by Geo. Partridge, Central Experimental Farm 121
Division, Field Husbandry:
Fertilizers, Profits from Manure and, by E. S. Hopkins, Dominion Field Husbandman 12
Division, Forage Crop:
Forage Crop Improvement, by G. P. McRostie, Ph.D., Dominion Agrostologist, Central Experimental Farm..... 514
Division of Illustration Stations:
Illustration Stations in Quebec, The Dominion, by John Fixter, Chief Supervisor 212
Division, Tobacco:
Tobacco Culture, Experiments in—
I. Tobacco Station, Harrow, Ontario, by D. D. Digges, Superintendent.. 116
II. Farnham Tobacco Station, by J. E. Montreuil, Superintendent..... 118

DAIRY AND COLD STORAGE BRANCH

Butter-Scoring Contest, 1922, The Dominion Educational, by George H. Barr..... 19
Cow Testing..... 520
Dairy and Cold Storage Branch, The..... 315
Dairy Station Notes, Finch..... 321
Milk Utilization Service 21
Report, Cow Testing 321

ENTOMOLOGICAL BRANCH

Apple Sucker (Psyllia mali Schmid), A Fungous Parasite of the Imported, by Alan G. Dustan, Assistant Entomologist..... 16
European Corn Borer in Ontario During the Summer of 1922, The Distribution of the, by L. S. McLaine, Chief, Division of Foreign Pests Suppression..... 31
Importation of Nursery Stock..... 521
Mosquito Control at Banff, Alberta, by Eric Hearle, Assistant Entomologist..... 218
Nicotine, The Susceptibility of Grape Leaf Hopper Eggs to, by W. A. Ross and W. Robinson, Dominion Entomological Laboratory, Vineland Station, Ontario.. 230

HEALTH OF ANIMALS BRANCH

Fox, Registration of the Silver Black, by W. G. Church, V.S., Chief Inspector..... 23
Fruits and Vegetables, Canadian Government Standards for Canned, by C. S. McGillivray, Chief Canning Inspector..... 228
Tuberculosis in Canada, Bovine..... 24

LIVE STOCK BRANCH

Egg Standards, Canada's, by Ernest Rhoades, B.S.A., Assistant Chief, Poultry Division 28

SEED BRANCH

Competitions in the Province of Quebec, Seed Grain, by Jules Simard, District Inspector 431
Elevator Screenings, Further Classification of, by George H. Clark, Seed Commissioner 314
Seeds Act, 1923, The 522

PART II

PROVINCIAL DEPARTMENTS OF AGRICULTURE

NOVA SCOTIA

Legislation, 1923, Provincial Agricultural 450

NEW BRUNSWICK

Agricultural Representative Work in New Brunswick, by J. E. McIntyre, B.S.A., Bathurst 543
Fertilizer Needs Half-way, Meeting the Farmers', by O. C. Hicks, B.S.A., Superintendent of Soils and Crops 134
Legislation, 1923, Provincial Agricultural 450
Societies of New Brunswick—Their Origin and History, Agricultural, by M. A. MacLeod, Superintendent. 441

ONTARIO

Commodity Co-operation in Ontario, by W. Roadhouse, Deputy Minister of Agriculture. 39
Fair, 1922, The Royal Agricultural Winter, by R. W. Wade, Director, Live Stock Branch, Ontario Department of Agriculture 124
Legislation, 1923, Provincial Agricultural 445
Live Stock Train, Ontario's Better, by L. Stevenson, Secretary and Supervising Director, Department of Agriculture 340
Nut Culture—A New and Interesting Branch of Horticulture, by James A. Nelson, B.S.A., Lecturer in Horticulture, Ontario Agricultural College, Guelph 323
Societies of Ontario, Agricultural The, by J. Lockie Wilson, Superintendent 541
Water Supply in the Farm House, The, by L. Stevenson, B.S.A., Director of Extension, Ontario Agricultural College 440

QUEBEC

Agricultural Association, The Work of the Quebec, by Oscar Lessard, Secretary of the Council of Agriculture. 242
Agriculture and Domestic Science in Quebec, The Teaching of, by A. Desilets, B.S.A., Quebec Department of Agriculture 127
Demonstration Farms of the Quebec Department of Agriculture, The, by L. Philippe Roy, Chief of the Field Husbandry Division 35
Early Laying—Its Economic Significance, by M. A. Jull, MacDonald College 244
Legislation, 1923, Provincial Agricultural 446
Poultry, A System of Pedigreeing, by Morley A. Jull, Ph. D., MacDonald College. 40
Poultry Keeping in the Province of Quebec, The Progress of, by Rev. Br. Liguori, Chief or the Poultry Division 331

MANITOBA

Agricultural Instruction Act and Its Effect on Rural Citizenship in Manitoba, The, by S. T. Newton, Superintendent, Extension Service 129
Bovine Reproduction, Some Pathological Phases of, by Alfred Savage, Animal Pathologist, Manitoba Agricultural College 523
Dairy Industry, Some Aspects of the Manitoba, by L. A. Gibson, Dairy Commissioner. 45
Departmental Changes in Manitoba 546
Insects in Manitoba, Field Crop, by A. V. Mitchener, Assistant Professor of Entomology, Manitoba Agricultural College 333
Legislation, 1923, Provincial Agriculture 447
Legume Production in Manitoba, by T. J. Harrison, Professor of Field Husbandry, Manitoba Agricultural College 232
Minister of Agriculture for Manitoba, Hon. Neil Cameron 54

SASKATCHEWAN

Agriculture, The Saskatchewan College of, by W. J. Rutherford, Dean of Agriculture, University of Saskatchewan 48
Agricultural Society as an Extension Medium, The Saskatchewan, by John J. Rayner, Director, Extension Department, College of Agriculture, University of Saskatchewan. 50
Competition, Boys' and Girls' Dairy Cattle Judging 54
Dairying in Saskatchewan, by Professor A. E. Potts, Professor of Dairying, University of Saskatchewan. 337
Field Crop Improvement in Saskatchewan—
I. The Work of the Field Crops Branch of the Provincial Department of Agriculture, by M. P. Tullis, Field Crops Commissioner 234
II. Crop Improvement Work of the Field Husbandry Department, University of Saskatchewan, by Manley Champlin, Senior Professor of Field Husbandry. 237
Grasshopper Campaign, Saskatchewan, Final Report on 55
Legislation, 1923, Provincial Agricultural 447
Live Stock Outlook in Saskatchewan, The, by A. M. Shaw, Professor of Animal Husbandry, College of Agriculture, University of Saskatchewan 434
Shows, Flocks and Herds, A Visit to British, by J. G. Robertson, Live Stock Commissioner 543

ALBERTA

Clubs, Alberta Women's Institute Girls', by Jessie C. Macmillan, Director 52
Dairy Industry, The Reconstruction of Alberta's 131
Grasshopper Control in Alberta, by C. G. Groff 436
Legislation, 1923, Provincial Agricultural 448
Marketing Services, Alberta, by Colin G. Groff, Publicity Commissioner 240

BRITISH COLUMBIA

Cow-Testing Results in British Columbia, by G. H. Thornbery, Assistant in Charge .. 342
Dairying in British Columbia, by Henry Rive, Dairy Commissioner 544
Fair, Provincial Potato, by J. B. Munro, B.S.A., Soil and Crop Instructor 136
Legislation, 1923, Provincial Agricultural 451

PART III

SCHOOL AGRICULTURE AND RELATED ACTIVITIES

Agricultural Instruction in the Public School—Its Place and Meaning, by J. W. Gibson, M.A., Director of Elementary Agricultural Education, British Columbia, and A. C. Gorham, M.Sc., Agr., Director, Elementary Agricultural Education, New Brunswick. 58
Conference, Agricultural Education 63
Graduates in Agriculture, Families of 351
Milk Facts, Teaching 353

NOVA SCOTIA

Agricultural College Registration 70
Schools, Agriculture in the Nova Scotia, by L. A. DeWolfe, B.A., M.Sc., Director of Rural Science 143

NEW BRUNSWICK

Agricultural Instruction in the Public School—Its Place and Meaning, by A. C. Gorham, M.Sc., Agr., Director, Elementary Agricultural Education 60
Club Work in New Brunswick, Poultry, by F. Leslie Wood, B.S.A., Poultry Superintendent 251

ONTARIO

Agricultural College Registration 68
Agricultural Instruction in Ontario Schools, Federal Assistance to, by Dr. J. B. Dandeno 56
Agricultural Instruction for Juniors in Ontario, by R. S. Duncan, Director Agricultural Representatives 547
Bulletins and Pamphlets in the Schools, The Use of, by J. W. Firth, B.A., Normal School, Toronto 147
Schools, The Ontario Long Course, by L. Stevenson, B.S.A., Secretary and Supervising Director, Department of Agriculture 249
Schools, Ontario, Agriculture in High, by Dr. J. B. Dandeno, Inspector, Elementary Agricultural Classes 347

QUEBEC

Agricultural College Registration—Macdonald College 69

MANITOBA

Agricultural College Registration 69
Schools, Agriculture in Manitoba High, by R. B. Vaughan, Director of Technical Education 250

SASKATCHEWAN

Clubs, Saskatchewan Boys' and Girls', by Fred W. Bates, B.A., M.Sc., Director of Rural Education Associations, and Harry Saville, B.S.A., Organizer 138
Farm Boys' Camps, Saskatchewan—What They are, and How They Serve the Boys of the Province, by K. W. Gordon, Assistant Director of Agricultural Extension, University of Saskatchewan 140

ALBERTA

High School Agriculture in Alberta, by G. V. Van Tausk, M.A., B.Sc. (Ag. Ed.) 453
School Agriculture in Alberta, Development of, by G. V. Van Tausk, M.A., B.Sc. (Ag. Ed.) 145

BRITISH COLUMBIA

Agricultural Instruction in Secondary Schools, by J. W. Gibson, M.A., Director of Elementary Agricultural Education 344
Scholarship for Extension School Students in British Columbia 352

PART IV

SPECIAL CONTRIBUTIONS, REPORTS OF AGRICULTURAL ORGANIZATIONS PUBLICATIONS AND NOTES

Accredited Herd Register 550
Agricultural College Registration:
- Ontario 68
- Macdonald College 69
- Manitoba 69
- Saskatchewan 69
- Alberta 69
- British Columbia 70
- Nova Scotia 70

Agricultural Development Board, Report of the Ontario 161
Agricultural Shows in 1922, Canada's Record at Leading:
- Ontario, Saskatchewan, Alberta, Nova Scotia, New Brunswick, British Columbia 359

Agriculture, Scholarships in 266
Appointments and Staff Changes 74, 169, 270, 370, 463, 564
Associations and Societies 75, 170, 271, 370, 463, 565
Bacteriology at the Experimental Farm, Creation of the Division of 164
Butter Substitutes Excluded 562
Cattle and Chilled Beef, Experimental Shipment of 362
Cattle-Marking Order, Canadian 363
Cattle to Great Britain, First Shipments of Store 362
Cattle to Great Britain, The Admission of Canadian Store 154
Cheese-Scoring Contest, Dominion Educational 163
Conference, Cattle Exporters' 156
Conference, Dominion Live Stock Branch 67
Conference of Experimental Farm Superintendents 265
Conference on the Conservation of Wild Life 161
Corn Borer, A Parasite of the 364
Corn Borer, The European 365
Dairy Congress, World's 70, 366
Dairy Produce Grading 264
Dairying in Australia and New Zealand 364
Dairying in Australia, Will Investigate 165
Director of Experimental Farms and the Dominion Animal Husbandman to Visit Great Britain, The 164
Eggs Extended to Domestic Trade, Regulations for the Grading and Marking of ... 456
Exports, Cattle and Beef 71
Exports, Live Stock 560
Fairs and Exhibitions, Report of the Special Committee on 157
Farm Congress, International 366
Finch Dairy Station Report, The 162
Foxes Entering Prince Edward Island, Quarantine and Inspection of 562
Flax Experiments 560
Gift of Certain Breeding Animals to Canada by the British Shire Horse Association, The 165
Horticultural Council, The Canadian 556
Imperial Fruit Show, 1923 366
Insect and Pest Act, Amendments to the Regulations Under the 457
Insect Pests of Canada and the United States 365
International Congress on Cattle Breeding, 1923 167
International Grain and Hay Show—Canadian Awards 166
Irrigation Investigations in Alberta, by W. H. Snelson, Senior Irrigation Specialist, Irrigation Branch, Dominion Reclamation Service, Department of the Interior .. 148
Irrigation Practice, Economics of, by W. H. Snelson, Senior Irrigation Specialist 257
Land Lists, The Canadian Colonization Association's 561
Lantern Slides 166
Legislation, Dominion Agricultural 153
Library, The 76, 172, 274, 373, 465, 566
Medal Awarded, The Carter 261

Milk Industry, The Powdered, by B. A. Gould, President, Canadian Milk Products, Limited 459
New Publications 79, 175, 276, 371, 464, 565
News Items and Notes 72, 168, 267, 367, 461, 563
"Plant Breeding in Scandinavia" 71
Plant Originations Protected, New 559
Plant Registration Bureau, Canadian Horticultural Council 64
Poultry Record Established, Canadian National 165
Prizes at Macdonald College, Winners of Special 367
Rams and Boars, Assisted Importation of 266
Refrigeration, International Congress of 366
Rutherford, The Late John G 455
Scholarships in Agriculture, Graduate 166
Seed Board Meeting, Advisory 160
Seed for Export, Extension of Grading 68
Seed, Export Prospects for Canadian Registered 460
Seed, A New Source of Clover 460
Shire Horses to Canada, Gift of 363
Soil Fertility on the Water Requirements of Crops, The Influence of, by W. H. Snelson, Senior Specialist, Irrigation Branch, Dominion Reclamation Service 354
Vetinary Medical Association, Canadian 561
Vitamins, Vegetable, by L. F. Burrows, Secretary, Canadian Horticultural Council .. 558

PART V

INDEX TO FOREIGN AGRICULTURAL INTELLIGENCE

Aeration, Soil 576
Aeroplane, Transport of Market Produce by 187
Agricultural Education of the Future, Higher 569
Alfalfa:
- Production under Irrigation 181
- New Chinese Variety 283
- As a Pasture for Pigs 477
- Value of Lime and Inoculation on Acid Soils 576

Apple-Tree Canker, New Measure for Controlling 584
Beans, Influence of Various Manures on 385
Beekeeping:
- Insulating Capacity of Double Walled Hives 389

Bicarbonate of Ammonia, Advantages as a Fertilizer 472
Blueberries, Cultivation in United States 283
Borax in Fertilizers, Effect on Potato Growth 471
Bran, Connection between Degree of Milling and Food Value of 184
Breeding of Live Stock:
- Application of New Views Concerning Heredity 287
- Breeding Cattle for Milk and Beef Production 578

Butter:
- "Mottles" in Butter 88
- Common Defects and How to Avoid Them 391
- Investigations on the Oily Taste of Butter 583

Calcium Salts in Feeding Animals, Use of 284
Casein Industry and Production in Denmark 89
Cattle:
- Effect of Shelter and Temperature of Drinking Water on 184
- Improvement of Dairy Cattle by Milk Control in Denmark 184
- Identification by Means of Nose-Prints 388
- Should Milch Cows which React against Tuberculin be Sacrificed? 475
- Breeding for Milk and Beef Production 578

Cheese, Connection Between Number of Bacteria in Milk and Quality of 292
Clover:
- As a Green Manure 279
- Value of Lime and Inoculation on Acid Soils 576

Co-operative Live Stock Shipping Associations in United States 587

Cream:
Foaming of 479
Method of Measuring the Volume of Cream on Milk 582
Crop Statistics 97, 197, 296, 396, 488, 589
Dairying:
Improvement of Dairy Cattle by Milk Control in Denmark 184
Milk Control in Belgium 186
Variation of Percentage of Fat in Successive Samples of Milk 291
Butter-Fat Percentage Increased for Two Days by Partial Milking 389
Dogs, Sheepkilling 475
Education of the Future, Higher Agricultural 569
Eggs:
Shortening Incubation by Exposing Eggs to Radium 87
Problems of Incubation 289
Electricity:
Experiments on Use of Artificial Light on Growth of Plants 386
Electricity and Agriculture 389
Feeds and Feeding:
Comparative Value of Root Ration and Silage for Dairy Cows 86
Use of Calcium Salts in Feeding Animals 284
Advantages of Heavy Feeding of Milk Cows 288
Nutrient Requirements of Growing Chicks 288
Comparison between Chloride and other Calcium Salts as a Stock Feed 476
Experiments in Cattle Feeding in the U.S. Experiment Stations 477
Alfalfa as a Pasture for Pigs 477
Rape as a Pasture for Pigs 478
Fertilizers, *see* Manures and Manuring.
Field Experiments:
Standardization of 278
With Crop Rotation, Manures and Fertilizers 381
Fish Meal, Production of in United States 177
Flax Seed in Ireland, New 283
Flour, Effect of Variation of Milling on Digestibility of 81
Forests of the United States as a Source of Liquid Fuel 85
Fruits and Fruit Growing:
Study on the Pollen of Fruit Trees 387
New Test for the Maturity of Fruit 474
Fungi in the Soil, Method of Counting 468
Grassland 180
Green Forage Silage, Composition and Value of 581
Hygiene of Live Stock:
International Conference for Defence against Epizootic Diseases 86
Use of Stomosines in Treatment of Infectious Diseases 182
Effect of Chloropicrin Fumes on *Argas Reflexus* 183
Autopyotherapeutic Treatment of Strangles 183
Treatment of Contagious Entero-Hepatitis in Turkeys 290
A Disease of Young Pigs Consequent on Dry Years 388
Should Milch Cows which React against Tuberculin be Sacrificed? 475
Incubation:
Shortening Period by Exposing Eggs to Radium 87
Problems of 289
International Institute:
Publications of 176
Visit of King George to 376
Irrigation:
Production of Alfalfa Under 181
Influence on Composition of the Soil 380
Lettuce, Mosaic Disease of 89
Lime:
Influence on Germination 385
Value of Lime for Alfalfa and Clover on Acid Soils 576
Live Stock Shipping Associations in United States, Co-operative 587
Live Stock Statistics:
Denmark 99
The World's Live Stock 192
Germany 300

Live Stock Statistics:
Scotland 300
Ireland 300
Roumania 300
Belgium 300
England and Wales 597
Spain 597
India 597
Manganese:
Distribution of in Plants 177
Role of in Plants 383
Function of Manganese Fertilizers 469
Mangolds in Combination with Maize 387
Manures and Manuring:
Relation of Organic Matter and Feeding Power of Plants to the Use of Rock Phosphate. 82
Value of Nitrate of Soda, Green Manures and Stable Manure 83
Effect of Basic Slag on Grassland and Subsequent Crops 84
Supplies of Organic Matter in the Soil: Comparative Values of Fertilizers. 178
Sweet Clover as a Green Manure 279
Effect of Straw on the Biological Soil Processes 280
Influence of Wheat Straw on Accumulation of Nitrates in the Soil 281
Sowing Seeds and Scattering Fertilizers in Close Lines 381
Field Experiments with Crop Rotation, Manure and Fertilizers 381
Value of Tetraphosphate 382
Production of Phosphoric Acid by Electric Condensation and Precipitation. 383
Role of Manganese in Plants 383
Supplies of Nitrogen Fertilizers 384
Effect of Nitrates Applied at Different Stages of Growth of Wheat 384
Influence of Lime on Germination 385
Action of Various Manures on Beans 385
Relation Between Nitrogen in the Soil and Live Stock Farming 469
The Function of Manganese Fertilizers 469
Borax in Fertilizers: Its Effect on Potato Growth 471
Effect of Various Salts on Nitrogen-Fixing Properties of Soil 471
Effect of Continuous Application of Chemical Fertilizers on Soil Reaction.. 472
Bicarbonate of Ammonia as a Fertilizer 472
Chloride of Ammonium as Manure 473
Meteorology, Agricultural:
Critical Period of Wheat as Regards Rain 378
Agricultural Meteorology as a Field for Investigation 572
Milk and Milking:
Comparison of Fat Test in Milk as Determined by a Cow-Testing Association and by a Creamery 88
"Buttons" in Condensed Milk 88
Milk Control in Belgium 186
Variation of Percentage of Fat in Successive Samples 291
Connection between Number of Bacteria in Milk and Quality of Cheese. 292
Butter-Fat Percentage Increased for Two Days by Partial Milking 389
The Milking Machine and the Hygienic Qualities of Milk 390
Method of Measuring the Volume of Cream on Milk 582
Investigations on the Acid Content of Milk 583
Actinomyces in Milk Causing Odours and Undesirable Flavours 583
Milling:
Connection between Degree of Milling and Food Value of Brans 184
Mosquitos:
Animals Protecting Man From 177
Destruction by Eels 466
Nose-Prints, Identification of Cattle by Means of 388
Oats, Manshott III, a Variety Resistent to Lodging 180
Ocean Freight Rates 199, 299, 400, 492, 596
Pork Production 580

Potatoes:
Fixity of Characters in New Hybrids 179
Development of Potato Tubers 179
Effects of Light and Darkness in Storage 187
Artificial Production of "Tipburn" 188
Decree Prohibiting Entry into France 292
The Etiology of "Tipburn" 293
Influence of the Weight of the Set on the Crop 388
A New Potato Disease in Morocco 480
"Stipplestreak" and Other Diseases 583
Poultry:
Shortening Incubation by Exposing Eggs to Radium 87
Capons vs. Cockerels for the Market 87
Nutrient Requirements of Growing Chicks 288
Dryden Method of Choosing Laying Hens 290
Prices of Wheat and Rye 199, 299, 400, 492, 595
Publications of the International Institute 176
Radio-Telephone as a Means of Distributing Crop Reports 377
Rape as a Pasture for Pigs 478
Rothamsted Station: Experimental Work in Progress 466
Russia, Sugar Industry in 479
Salt, Influence of on Sugarbeets 178
Seeds:
Determining Value of Seed by Biochemical Means 180
New Flax Seed in Ireland 283
Biochemical Index for Determining Value of 283
Sheepkilling Dogs in the United States 475
Silage, Composition and Value of Green Forage 581
Sodium in Soil Sterilization, Arsenate of 576
Soils:
Measuring Soil Toxicity, Acidity and Basicity 84
Soil Fatigue 379
Influence of Irrigation on Composition of the Soil 380
Teaching of Soil Bacteriology 466
Necessity of Defining Soil Types in Investigations on Yield 469
Soil Aeration 576
Soya Beans, World's Production of 181
Sprays and Spraying:
Spreading and Adherence of Arsenical Sprays 92
Fungicidal Dusts for the Control of Wheat Smuts 187
Selection and Treatment of Waters for Spraying Purposes 474
Poisonous Metals on Sprayed Fruits and Vegetables 577
Straw:
Effect on Biological Soil Processes 280
Influence on Accumulation of Nitrates in the Soil 281
Strawberry Root-Worm in California 92
Sugar Industry in Russia 479
Sugarbeets, Influence of Salt on 178
Sunflowers in Italy, Oil Bearing 182
Turkeys:
Treatment of Entero-Hepatitis with Ipecacuanha 290
Breeding of in Missouri 290
Vines, Sulphate of Iron and Perchloride of Iron for Chlorosis of 292
Wheat:
Fungicidal Dusts for the Control of Smut 187
A Monograph on the Wheat Plant 281
Cost of Production in Several States 290
Critical Period as Regards Rain 378
Effect of Nitrates Applied at Different Stages of Growth 384
The World's Wheat 1922-23 and 1923-24 393
The Tillering of Wheat 474
The Wheat Requirements and Supplies for 1923-24 484

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